They Don't Just Eat Grass

Objective

Students will read about healthy feeding programs for farm animals. Students determine the best graphing method for information about animal nutrition and plot numbers provided. Students will relate information about balance in animal diets to balance in their own diets and mix their own balanced "rations."

Background

Grass is one of our most plentiful resources in Oklahoma, and most beef producers take advantage of this by grazing their cattle on pasture whenever possible. Beef cattle graze many areas in Oklahoma that are unsuitable for growing crops. They transform grass, which people cannot digest, into protein (meat) that people can eat. Cattle are even allowed to graze on winter wheat in the fall and early spring. When the wheat is dormant or covered with snow, supplementary feed is provided. The cattle are removed from the wheat before it reaches its jointing stage to allow it to mature and ripen for harvest in late spring/early summer.

Cattle eat food for energy and nutrients. Just as humans need variety and balance in their diets, animals need more than just grass to stay healthy. Food eaten by animals is called "feed." Animal feed provides energy, fat, and fiber; protein for the development and maintenance of muscles and the synthesis of hormones and enzymes; and vitamins and minerals, important for the growth and maintenance of bones and other body systems.

The type and amount of feed necessary depends on the species, size, and "job" of the animal (plow horse, milk cow, beef steer, etc.). Nutritional needs are different for animals that are monogastric (horses) than they are for those that are ruminant (cattle). Larger animals or animals that are working, bred, lactating, or growing usually have higher nutrient requirements than those animals that are just being maintained at their current condition.

There are many tables and books of research data that help beef producers determine the nutrient and energy requirements of their animals. Once the nutrient and energy requirements are determined, the producer may have feed custom-mixed or may buy commercial feed.

Animal feeds usually consist of grain, a protein source and plant byproducts. A byproduct is what remains after the part of the plant used for human food has been removed. Wheat middlings (mids) are a byproduct of the wheat seed that remains after the part used in making flour has been removed. Brewer's grains are a byproduct of the brewing industry that result from drying mash solids. Soybean hulls are a byproduct of processing soybeans for soybean meal.

Some feed mixes, called sweet feed, are lightly sweetened with molasses. Just like humans, animals like foods that are sweet, so one purpose of the molasses is to make the food taste better. Another purpose for the molasses

Oklahoma Academic Standards

GRADE 5

Number & Operations: 1.1, 2,4; Algebra: 2.1; Data & Probability: 1.1,2
Physical Science: 3-1; Life Science: 2-1

GRADE 6

Number & Operations: 1.3,4,6; 3.1,3; 4.1,4; Algebra: 1.1,2; 2.1; 3.1; Geometry & Measurmeent: 3.1,2; Data & Probability: 1.1,2,3
Life Science: 1-3; 2-1,5
Health: 1.4,13; 3.10; 6.3; 7.1

GRADE 7

Number & Operations: 2.1,3,5; Algebra: 1.2; 2.1,3,4; 3.2,3; Data & Probability:1,1,2
Health: 1.4,13; 3.10; 6.3; 7.1

GRADE 8

Pre-Algebra: A.2.1,2; 4.2,3; Data & Probability: 1.2,3
Life Science: 1.7; Earth Science: 3.1,4
Health: 1.4,13; 3.10; 6.3; 7.1

is to catch all the fine bits of grain that otherwise would end up as dust. Sometimes molasses also masks poor quality feed.

There are two basic kinds of commercially-available animal feed: supplements, which are designed to be fed along with hay or other forage materials, and complete feeds, which are designed to be the only source of food for the animal. Commercial feeds are labeled with the species for which they are intended, a guaranteed analysis of the nutrients, the feed ingredients, and directions for use (how much to feed per unit of weight, etc.).

Even when a feeding routine is in place, other factors come into play. Extreme heat or cold, wind chill, moisture, illness, stress, parasite infestation and other factors affect nutritional and energy requirements. Monitoring feed requirements and intake is just one of the many responsibilities of raising livestock.

Background sources: Damron, Stephen W., *Introduction to Animal Science: Global, Biological, Social and Industry Perspectives,* 3rd ed., 2006. Freeman, David W., "Feed Tag Information for Commercial Feeds for Horses," OSU Extension Fact Sheet F-3919. "Ration Formulation for Horses," OSU Extension Fact Sheet F-3997, "Use of By-Product and Nontraditional Feeds for Horses." Dumler, Troy, "Winter Wheat Grazing," Kansas State University Fact Sheet MF-1009.

Materials

food scale or other weight measure

measuring cups

measuring spoons

gallon-sized plastic bag or large clear bowl

quart-sized plastic bags

assorted dry cereals (grain group)

assorted dried fruit (fruit group)

assorted nuts and seeds, e.g., sunflower seeds, pumpkin seeds, etc (meat and bean group)

Procedures

1. Read and discuss background and vocabulary.
2. Hand out copies of the "Net Energy for Maintenance Table" provided with this lesson.
   —Randomly assign to each student one category of feed type from the table (roughages, grazed forages, etc.)
   —Students will find the measures of central tendency for the numbers in the assigned categories.
   —Students will explain and justify which measure of central tendency would provide the most descriptive information for the data.
3. Students will use two different colors to plot the net energy maintenance (NEM) and percentage fat of each feed on the same graph.
   —After completing their graphs, students will answer the "NEM Table Questions," included with this lesson.
   —Students may work in groups or individually.
   —Discuss answers as a class.
4. Lead a class discussion about balanced nutrition for animals and humans.
   —Students will list components of a balanced diet for middle school students.
   —Students will brainstorm to develop a list of ingredients for a balanced feed mix for humans.
5. Explain to students that you will be mixing a human feed mix which includes USDA daily recommended portions of grain, fruit and nuts for middle school-aged students (9-13).
   —Provide students with copies of the human feed ration chart included with this lesson.

—Students will read from the chart as the teacher or student volunteers mix the correct portions of dry cereal, dried fruit and nuts in a clear bowl or gallon-sized plastic bag to create a daily ration.
—Show students the completed ration, and lead a discussion about student diets compared with the USDA recommendations. What has been left out? (milk and vegetables)
—Weigh the completed ration.

6. Students will follow the directions on the worksheet to create their own feed mix.
—Students will calculate the amount needed of each ingredient for 1/3 of the daily recommendation.
—Students will measure each ingredient to make their own ration.
—Students will weigh their own rations. Are individual rations 1/3 the weight of the daily ration prepared in Activity 3? If not, why not?
—Provide raw veggies and yogurt to complete USDA recommendations for a balanced ration.
7. Students will develop a recipe for granola that is nutritionally balanced, based on the USDA daily recommendations. Possible ingredients include oats, dried fruit, wheat germ, dry milk solids, nuts, seeds, etc.

Additional Resources

Damerow, Gail, *Barnyard in your Backyard: A Beginner's Guide to Raising Chickens, Ducks, Geese, Rabbits, Goats, Sheep, and Cows*, Storey, 2002.

Kindschi, Tara, *4-H Guide to Raising Chickens,* Voyageur, 2010.

King, Hazel, *Carbohydrates for a Healthy Body,* Heinemann, 2009.

Macaulay, David, The Way We Work, Houghton Mifflin, 2008.

Miller, Edward, *The Monster Health Book: A Guide to Eating Healthy, Being Active and Feeling Great for Monsters & Kids,* Holiday House, 2008.

Patrick, Jean LS, and Alvis Upitis, *Cows, Cats and Kids: A Veterinarian's Family at Work,* Boyd's Mills, 2003.

Powell, Jillian, *Fats for a Healthy Body*, Heinemann, 2009.

Royston, Angela, *Proteins for a Healthy Body*, San Val, 2003.

Vocabulary

dormant—having growth or other biological activity much reduced or suspended
energy—power or ability to be active
enzymes—proteins that act as biological catalysts by speeding up chemical reactions in organisms, such as helping to break down nutrients in the digestive process
fiber—indigestible substance (cellulose, lignin, etc.) found in the cell walls of plants
forage—herbaceous plant material
hormones—chemicals made in one part of the body that act on a different part of the body (e.g., pituitary gland secretes hormones that act on reproductive organs); regulate metabolism, growth, etc.
lactating—producing milk
megacalories—1 megacalorie = 1000 kilocalories; 1 kilocalorie = 1 Calorie, which is what food energy is measured in (e.g., soda has 140 Calories a can); 1 Calorie is the amount of energy it takes to heat one kilogram of water 1 degree Celsius; large animal energy needs are measured in megacalories (mcal)
maintenance—the act of keeping in good condition
minerals—inorganic elements needed by livestock that must be provided in the diet since they cannot be synthesized by the animal or their microbes
monogastric—having one stomach
nutrient—a substance or ingredient that furnishes nourishment
protein—substance made of amino acids that makes up a large portion of the body—muscles, organs, skin, etc.
roughage—a feed with more than 18 percent indigestible fiber on a dry-matter basis
rumen—one of the compartments of the complex stomach of ruminants such as cattle; site of fermentation
ruminant—a cud-chewing mammal having a complex stomach with three or four chambers
silage—fermented forage used as animal feed
supplement—something that supplies what is needed or makes an addition
vitamins—a group of dissimilar organic substances necessary for growth and maintenance that cannot be synthesized by most animals and that are only needed in small amounts

Net Energy for Maintenance (NEM) Table

Choose one of the categories of feed from the table below. Use two different colors to plot the net energy maintenance (NEM) and percentage fat of each feed on the same graph.

NEM = Net energy for maintenance, expressed in megacalories (mcal) per 100 pounds (cwt) of feed; energy used to work muscles, maintain and repair tissue, keep a steady temperature, maintain homeostasis (a steady internal environment) but not grow or produce milk.

ROUGHAGE

TYPE OF FEED	NEM (Mcal/cwt	% fat in feed
alfalfa hay, early bloom	59	2.9
alfalfa hay, full bloom	52	2.3
alfalfa cubes	55	2.0
Bermuda hay, early bloom	49	1.9
Bermuda hay, full bloom	39	1.8
corn silage	77	3.1
cotton seed hulls	45	1.9
fescue hay, early bloom	55	3.5
peanut hulls	36	1.5
prairie hay	40	2.0
rice hulls	35	3.9
sorghum silage	58	2.7
sunflower seed hulls	42	2.2
wheat straw	43	1.8

Source: Lalman, David, "nutritive Value of Feeds for Beef Cattle," OSU Extension Fact Sheet F-3018

GRAZED FORAGE

TYPE OF FEED	NEM (Mcal/cwt	% fat in feed
native range, Jan-March	42	1.7
native Range, April-June	74	3.2
native range, July-Aug	65	3.0
native range, Sept-Oct	58	2.5

BY-PRODUCT FEEDS

distillers grain w/soluble corn	104	10.6
soybean hulls	84	2.6
wheat bran	74	4.5

FEED GRAINS

corn grain, whole	99	4.3
corn grain, steam flaked	106	4.1
milo, cracked, rolled or ground	74	4.5
milo, steam flaked	102	3.1

HIGH PROTEIN MEALS/SEEDS

cottonseed, whole	108	17.8
soybean meal, 48%	98	1.2
soybeans, whole	106	18.8
sunflower seeds, high oil	142	42.0

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NEM Table Questions

Use the "Net Energy for Maintenance (NEM) Table" and work with a partner to answer the following questions:

1. Which category of feedstuffs (roughage, feed grains, etc.) have the highest NEM?

2. Which category of feedstuffs have the highest percentage of fat?

3. For the hays and forages, does the season or cutting (early versus late bloom) affect the amount of energy and fat available?

4. Should it take more energy to produce meat, milk, etc., than to maintain weight?

5. What is a possible reason for your answer? Discuss your thoughts with your partner.

6. How might this feed information be used by a producer?

7. If hay costs were the same and you had a herd of horses that were in good condition and didn't need to gain weight, which hay would you buy?

   Why?

8. The NEM is calculated on a "dry matter" basis. In other words, the samples are dehydrated first and then the megacalories are determined. Why do you suppose it is done that way?

9. Is there a direct correlation between the amount of NEM in a feed and the percentage of fat in the feed?

   Why or why not?

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NEM Table Questions (answers)

Use the "Net Energy for Maintenance (NEM) Table" and work with a partner to answer the following questions:

1. Which category of feedstuffs (roughage, feed grains, etc.) have the highest NEM?
   high protein meals/seeds

2. Which category of feedstuffs have the highest percentage of fat?
   high protein meals/seeds

3. For the hays and forages, does the season or cutting (early versus late bloom) affect the amount of energy and fat available?
   hay—The early bloom has more net energy and fat content.
   grazed forage—April-June is the highest.

4. Should it take more energy to produce meat, milk, etc., than to maintain weight?
   yes

   What is a possible reason for your answer? Discuss your thoughts with your partner.

5. How might this feed information be used by a producer?
   Knowing the time of year, energy and fat content in the feed could help the producer tailor the feed to his/her specific needs (maintenance or production)

6. If hay costs were the same and you had a herd of horses that were in good condition and didn't need to gain weight, which hay would you buy?
   Bermuda hay

   Why?
   lowest in fat content

7. The NEM is calculated on a "dry matter" basis. In other words, the samples are dehydrated first and then the megacalories are determined. Why do you suppose it is done that way?
   Water aids in body maintenance and digestion but has no nutritional or energy value.

8. Is there a direct correlation between the amount of NEM in a feed and the percentage of fat in the feed?
   No. Early bloom alfalfa hay 59 X .029 = 1.711; Full bloom alfalfa hay

   Why or why not?

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Name_____

Human Feed Ration

Livestock producers watch the calorie intake of their animals to promote the correct amount of weight gain without producing meat that is too fat. Animals also need energy from calories to stay warm and healthy.

Young people also need calories for energy, but people are not animals and usually don't have someone regulating their calorie intake as closely as farmers regulate the diets of their animals. People must make their own choices. Calories provide the fuel we need to keep going, but eating too many calories—and not burning enough of them off through activity—can lead to weight gain.

Young people, aged 9-13, need between 1600 and 2500 calories per day. If you eat more calories than your body needs, the leftover calories are converted to fat. Too much fat can lead to health problems. young people who are overweight can start by avoiding high-calorie foods, such as sugary sodas, candy, and fast food, and by eating a healthy, balanced diet. Exercising and playing are really important, too, because activity burns calories.

More important than watching calories is eating a variety of foods. The US Department of Agriculture (USDA) recommends eating foods from all the food groups every day.

USDA Daily Recommendations

	GRAINS	VEGETABLES	FRUITS	DAIRY	PROTEIN
Girls 9-13	5 ounces ready-to-eat cereal	2 cups	3/4 cup dried fruit	3 cups milk	2 1/2 ounces nuts or seeds
Boys 9-13	6 ounces ready-to-eat cereal	2 1/2 cups	3/4 cup dried fruit	3 cups milk	2 1/2 ounces nuts or seeds

Source: USDA ChooseMyPlate.gov: http://www.choosemyplate.gov/MyPlate

Use the ingredients provided to create a snack mix with ingredients from the GRAIN, FRUIT and PROTEIN Groups. (Nuts and seeds are included in the "Protein" group.) Use the chart above to calculate how much you need of each ingredient. Your snack mix should provide 1/3 of the daily recommendation from these three groups.

	GRAINS	FRUITS	PROTEIN
Food Used			
Amount of food needed (1/3 of daily recommendation)			

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