

Unit C: Meeting Nutritional Needs of Animals

Lesson 4: Meeting Mineral and Vitamin Requirements

Student Learning Objectives:

Instruction in this lesson should result in students achieving the following objectives:

1. Identify the mineral requirements of cattle.
2. Identify the vitamin requirements of cattle.

Recommended Teaching Time: 1 hour

Recommended Resources: The following resources may be useful in teaching this lesson:

Naseri, Alimuddin. *Animal Nutrition Training Manual*. www.atnesa.org/docs/Alimuddin-Naseri-Animal-Nutrition-Manual.pdf

List of Equipment, Tools, Supplies, and Facilities:

- Writing surface
- PowerPoint Projector
- PowerPoint Slides
- Transparency Masters

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slides 2):

- Calcium
- Cobalt
- Copper
- Fat soluble vitamins
- Iodine
- Iron
- Magnesium
- Major minerals
- Manganese
- Phosphorus
- Potassium
- Sodium chloride
- Sulfur
- Trace minerals
- Vitamin A
- Vitamin B
- Vitamin C
- Vitamin D
- Vitamin E
- Vitamin K
- Water soluble vitamins

Interest Approach:

Ask the students the following questions and discuss each: “So we have already discussed energy and protein. What other nutrients do animals get from feedstuffs?” Guide the students to the answer of minerals and vitamins. “What is the function of minerals and vitamins, in general?” Guide the students to the answer – body function. Transition to the first objective on the mineral requirements for cattle.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Identify the mineral requirements for cattle.

Anticipated Problem: What are the mineral requirements for cattle?

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- I. The important minerals in cattle feeding are divided into two groups:
 - A. **Major minerals** include calcium, phosphorus, potassium, sodium chloride, sulfur, and magnesium.

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1. **Calcium** is the most abundant mineral in the body. Ninety-nine percent of the total Calcium in the body is found in the skeleton and teeth of animals.
 - a. Deficiency symptoms include rickets (misshapen bones, lameness) especially in calves and milk fever (hypocalcaemia - low blood calcium level)
 - b. Sources of Calcium include bonemeal, shell meal, meat meal, fish meal, milk, legumes, pulses, dicalcium-phosphate.
 - c. Calcium utilization is strongly related with phosphorus (P) and vitamin D.

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2. **Phosphorus** is used in bone formation and is in close association with calcium and vitamin D. Phosphorus is known to have more functions in the animal body than any other mineral.
 - a. Deficiency symptoms include rickets; chewing wood, bones, rags, etc; poor fertility; lower milk yield
 - b. Sources include cereal grains, bonemeal, dicalcium P, milk, and fish meal.

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3. **Potassium** is important for osmotic regulation of the body fluids and regulation of the acid-base balance in the rumen.
 - a. Deficiency is very rare, although excess potassium may interfere with the absorption of Magnesium which leads to hypomagnesia (grass staggers or grass tetany which is the result of low levels of magnesium in the blood).
 - b. Plants generally have high concentration of potassium.

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4. **Sodium chloride** is also known as table salt. Sodium chloride functions (with K) in acid-base balance and the osmotic regulation of body fluids. This is extremely important in warm climates because animals are sweating.
 - a. Deficiency symptoms include general poor performance including poor growth and infertility.
 - b. The main source of NaCl is through a “lick” or in a special water trough. Most feedstuffs (especially plant-based) have low concentrations of NaCl.

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5. **Sulfur** is found in body proteins.
 - a. Deficiency symptoms are caused by a protein deficiency in the ration
 - b. Sources of sulfur include protein rich sources such as soya cake, cotton seed cake, or sodium sulfate. Extra sulfur needs to be added to diets that have large amounts of Non Protein Nitrogen (NPN). An example of NPN is urea.

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6. **Magnesium** is closely related to Ca and P. The skeleton contains 70% of the body's magnesium.
 - a. Deficiency is common in milk fed calves between 50-70 days of age. Symptoms include poor bone formation and hypomagnesemia.
 - b. Sources include wheat bran, legumes, plant protein cakes like cottonseed cakes and soya cakes.

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- B. **Trace minerals** include iron, copper, cobalt, iodine, and manganese.
1. Ninety percent of the **iron** in the body is combined with proteins.
 - a. Deficiency symptoms include anemia, especially in young calves which are fed on milk. Adult cattle have less incidence of Fe deficiency because most feedstuffs have substantial amounts.
 - b. Sources include green leaves, legumes, seed coats and meat, bone and fish meal.

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2. **Copper** is used in haemoglobin formation and pigmentation.
 - a. Deficiency symptoms include anemia, dull coat color, infertility, and scouring.
 - b. Copper is easily found in most feedstuffs. Extra sources of Cu include seeds and seed by-products.

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3. **Cobalt** is necessary for rumen microorganism function in association with vitamin B12.
 - a. Deficiency symptoms include emaciation, anemia, and pining.
 - b. Most feedstuffs have normal amounts of Co.

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4. **Iodine** is important in thyroid gland function.
 - a. Deficiency symptoms include enlargement of the thyroid gland. This may result in breeding problems and birth of hairless, weak or dead calves.
 - b. Sources include Brassica family feedstuffs (kale, rape, rape seed, cabbage), soya beans, peas, and ground nuts. Iodized salt can also be used as an iodine supplement.

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5. **Manganese** is an important enzyme activator.
 - a. Deficiency usually does not occur because such small amounts are needed.
 - b. Most feedstuffs contain Mn, especially wheat bran, ricebran, and seeds.

Use TM: 4-1 to review the major minerals and trace minerals needed by cattle.

Objective 2: Identify the vitamin requirements for cattle.

Anticipated Problem: What are the vitamin requirements for cattle?

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II. Vitamins are need in very small amounts, but are still indispensable. They are sorted into two categories:

A. **Water soluble vitamins** include vitamin B complex and vitamin C.

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1. **Vitamin B** is a group of vitamins that are produced in the rumen.
 - a. Deficiency is not likely in ruminants, except if the diet is deficient in cobalt.
 - b. Sources include bran, milk, and brewers grain.

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2. **Vitamin C** is synthesized by animals and therefore there is no deficiencies.
 - a. Rich sources include green leafy vegetables, citrus, and potatoes.

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B. **Fat soluble vitamins** include vitamin A, D, E, and K

1. **Vitamin A** assists in maintaining healthy skin and eyes.
 - a. Deficiency symptoms include dry skin, infections of the skin and eyes, diarrhea, and infertility.
 - b. Rich sources of vitamin A include green feedstuffs.

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2. **Vitamin D** assists in depositing Ca and P and is produced by the skin when exposed to sunlight.
 - a. Deficiencies include rickets (similar to Ca and P) and will not occur in animals that are outdoors.
 - b. Rich sources of vitamin D includes sun dried feedstuffs such as hay and straw.

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3. **Vitamin E** is important in fertility and is related to Selenium and muscle development.
 - a. Sources include green foods and cereal grains.
4. **Vitamin K** is important in blood clotting.
 - a. Deficiencies do not occur frequently.
 - b. Sources include green fodders but ruminants synthesize vitamin K.

Use TM: 4-2 to review water soluble vitamins and fat soluble vitamins. Be sure students understand the function and source of each vitamin.

Review/Summary: Focus the review and summary of the lesson around the student learning objectives (**PowerPoint Slide 21**). Call on students to explain the content associated with the objectives.

Application: Application can involve the students gathering examples of plants and/or grains that can be used to provide the necessary vitamins needed by cattle for proper body maintenance.

Evaluation: Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activity. A sample written test is included.

Answers to Sample Test:

Matching

1. D
2. E
3. J
4. A
5. G
6. I
7. H
8. B
9. C
10. F

Fill-in-the-blank

1. Iron
2. Water soluble vitamins
3. Vitamin D
4. Vitamin E
5. Vitamin K

Short Answer

Water soluble vitamins are the vitamin B complex and vitamin C.
Fat soluble vitamins are vitamin A, D, E, and K.

Meeting Mineral and Vitamin Requirements

Name: _____

Matching: Match each word with the correct definition.

- | | |
|--------------|--------------------|
| a. Calcium | f. Manganese |
| b. Cobalt | g. Phosphorus |
| c. Copper | h. Potassium |
| d. Iodine | i. Sodium chloride |
| e. Magnesium | j. Sulfur |

- _____ 1. Important in thyroid gland function.
- _____ 2. Closely related to Ca and P.
- _____ 3. Found in body proteins.
- _____ 4. The most abundant mineral in the body.
- _____ 5. Used in bone formation and is in close association with calcium and vitamin D.
- _____ 6. Also known as table salt.
- _____ 7. Important for osmotic regulation of the body fluids and regulation of the acid-base balance in the rumen.
- _____ 8. Necessary for rumen microorganism function in association with vitamin B12.
- _____ 9. Used in haemoglobin formation and pigmentation.
- _____ 10. An important enzyme activator.

Fill-in-the-blank: Complete the following statements.

- Ninety percent of the _____ in the body is combined with proteins.
- _____ include vitamin B complex and vitamin C.
- _____ assists in depositing Ca and P and is produced by the skin when exposed to sunlight.
- _____ is important in fertility and is related to Selenium and muscle development.
- _____ is important in blood clotting.

Short Answer: Answer the following question.

Which vitamins are water soluble vitamins? What vitamins are fat soluble vitamins?

MINERALS

- Major minerals
 - Calcium
 - Phosphorus
 - Potassium
 - Sodium chloride
 - Sulfur
 - Magnesium
- Trace minerals
 - Iron
 - Copper
 - Cobalt
 - Iodine
 - Manganese

VITAMINS

- Water soluble vitamins
 - Vitamin B complex
 - Vitamin C
- Fat soluble vitamins
 - Vitamin A
 - Vitamin D
 - Vitamin E
 - Vitamin K