Toxins and Your Animal

Overview:

The *Toxins and your Animal* lesson is designed to introduce the topic of toxicology. It will stimulate participants to consider how their animals could be exposed to toxic materials and efforts they can take to prevent health concerns. The lesson includes a hands-on activity that will help reinforce the impact toxic materials can have on animals.

Image 1: Sample supplies set-up before the lesson.

Objectives:

After completing this activity, participants will be able to:

- Explain what a toxin is and provide examples of toxins.
- Analyze various inputs and decide if they will have a positive or negative impact on an animal.
- Describe ways that an animal could be exposed to a toxin and how they can reduce the risk of exposure.

Skill Level:

Beginner to Intermediate

Life Skills:

Disease prevention, communication and critical thinking

Setting:

An outdoor space with easy clean-up; seating is optional

Time:

20–30 minutes

Materials:

- ❏ Two 16.9-ounce or larger bottles of soda
- ❏ Recommended: any cola-type soda (preferred example – Diet Coke)
- ❏ Two clear plastic 16-ounce cups
- ❏ One package of circular mints that are porous and sugar-coated (Recommend Mentos Mint for largest reaction)
- ❏ Approximately 4 ounces of water
- ❏ Two pieces of lettuce that can fit in a 16-ounce cup floating on the soda
- ❏ Paper towel (for clean-up of soda)
- ❏ Trash bag

PROCEDURE:

Before the meeting:

1. Review the *Toxins and Your Animal* lesson and gather any supplies you may need.
2. Prepare your demonstration area somewhere that will be easy to view and easy to clean. It is recommended to do this activity on a folding table outside in a grassy area. Gather the soda, circular mints, water and lettuce to be able to start the activity. Do not pour the soda yet – this may cause it to go flat.

Table 1. What is a toxin?

Item	What it represents	Impact it has on the animal
Circular mints	Toxin (such as a toxic plant, chemical or bacterium)	Negative effects such as sickness, neurological disorders or death
Water	Water an animal would consume in a given day	Hydrates the animal, keeps the digestive tract functioning properly and stabilizes temperature
Lettuce	Feed (such as grain, forage and supplements)	Supplies the animal with nutrients, allows the animal to express natural behavior (particularly when grazing), and aids in growth and performance
Reaction (large amounts of fizzing)	A negative effect on the animal	Could cause major health issues in animals

During the meeting:

1. Introduce the activity by reading aloud or paraphrasing the following:

   Each day, your animal is exposed to countless factors. Some of these factors have a positive impact on your animal, such as hay, grain, exercise, shade, water, etc. However, some things that your animal can be exposed to have a negative impact. One type of factor that creates a negative impact is ***toxins****. Toxins are poisons and will cause harm. Toxins can occur in multiple forms, such as chemicals, bacteria and plants. It is important to recognize what could be toxic to your animal and how to reduce exposure to toxins.*

   In today's lesson, we will discuss how toxins affect your animal and how you can be thoughtful about reducing your livestock or pet's exposure to toxic materials.

2. Discuss what the diet soda and reactions represent with the group. Read aloud or paraphrase the following:

   Diet soda: *The diet soda in the plastic cups represents your animal. We will be observing what happens when our animals ingest various items in their diet. What an animal consumes can have either a positive, neutral (no change) or negative impact on them, depending on what their needs are and how their internal systems react to each item.*

   A reaction: *In this lesson, large amounts of fizzing represent a negative impact on your animal. Negative impacts can be minor or major depending on what the impact is. For example, if an animal eats something that upsets its stomach, that would be a minor reaction that probably won't do any major damage to your animal, though it could cause your animal to have a poor appetite until it feels better.*

Sometimes a negative impact could be major, such as severe illness or death after an animal ingests a poisonous chemical.

3. Discuss what the lettuce and water represent with the group. Read aloud or paraphrase the following:

   Lettuce: *The lettuce represents the feed or other positive inputs that your animal would consume. The quality of feed that your animal consumes will affect its body condition score, growth rate, nutrition and performance level. It is important to keep in mind your animals' nutrient requirements and to feed them accordingly.*

   Water: *The cup of water represents your animal's normal daily intake of water. Water is the most essential nutrient for an animal, without it, your animal would become dehydrated and, in severe cases, could die.*

4. Ask the participants, "What are some other things beyond feed and water that might have a positive impact on your animal?"

   Fresh air, clean bedding and stalling areas, exercise, shade, temperature regulation (windbreaks, barns, fans, sprinklers).

5. Open your two 16.9-ounce bottles of diet soda. Pour half of one bottle of your diet soda into one plastic cup until the cup is half full. Repeat this with the other cup and the full bottle of soda. Recap both bottles until ready to use later. You should have two cups that are half full, and both bottles should have approximately the same amount of soda left. Read aloud or paraphrase the following:

   In the demonstration, we will observe the reactions that are taking place internally in our animals when they consume various items. Each cup represents a different type of interaction that an animal may encounter.

6. **Cup one:** Place the lettuce pieces in one of the existing cups of diet soda and show it to the participants. There is no reaction. Read aloud or paraphrase the following:

   The lettuce represents feed. The animal's digestive system will work to break down the feed and absorb the nutrients provided by the feed. The animal will then be able to continue to grow, produce or perform normally. By providing our animals with the necessary nutrients, we are keeping them healthy. For example, when we give a dairy cow (a female that has had a calf) a high quality feed each day, she can continue to produce adequate amounts of high quality milk. If this dairy cow was not given a high enough quality or quantity of feed, she would be unable to maintain the same level of production that she does when fed properly.

7. Ask the participants, "What are some ways that a balanced diet can have a positive impact on your animal?"

   Increased production, faster growth rates, stronger immune systems, more energetic, higher conception rates, improved overall health.

Image 2: There is no reaction with the water and lettuce.

8. **Cup two:** Pour approximately 4 ounces of the water into the second cup of diet soda and show it to the participants. There is no reaction. Read aloud or paraphrase the following:

   Water is the most important part of your animals' diet. Providing your animal with fresh, clean water is essential to keeping them healthy. The amount of water your animal needs is highly dependent on the species, age, size, stage of lactation, time of year and work required from the animal. Knowing the amount of water your animal needs and making sure they have access to an adequate volume of clean water is highly important. For example, a lactating (milk-producing) sow (female pig that has had piglets) can require up to 5 more gallons per day than a non-lactating sow (female not producing milk). Therefore, it is essential to know what stage of production your animal is in and how that affects water requirements.

9. Ask the participants, "How can access to clean water have a positive impact on your animal?"

   Increased production, faster growth rates, stronger immune systems, more energetic, higher conception rates, improved overall health.

10. Ask the participants, "How can restricting or not having access to clean water have a negative impact on your animal?"

    Decreased production, slower growth rates, depressed immune systems, lethargic, lower conception rates, decreased overall health.

11. Discuss what the circular mints represent with the group. Read aloud or paraphrase the following:

    As you saw with the two cups, the impact on an animal can be positive or neutral. Now, let's focus on items that always have a negative impact.

    Circular mints: The circular mints represent a toxic material such as a toxic plant, chemical or bacterium. Any kind of toxic material that your animal comes into contact with will have negative consequences. These negative effects will vary depending on what species of animal you own and what type of toxin the animal is exposed to.

12. Ask the participants, "What toxins might an animal come into contact with?"

    Poisonous plants, bleach or other disinfectants, mold, antifreeze, or pesticides such as rat/mouse poisons or insecticides.

13. **Bottle one:** Uncap both bottles of soda. Place one circular mint in one bottle of soda and allow the participants to watch the reaction. The reaction should be a fizzing to the top of the bottle. Read aloud or paraphrase the following:

    An animal can be exposed to different levels of toxins. The reaction of only one circular mint in the diet soda represents an animal that has been exposed to a small amount of

a toxin, such as a horse that ingests a small amount of buttercup (a toxic plant). The horse will likely experience increased salivation, decreased appetite and an upset stomach. This exposure makes the horse uncomfortable and sick for a short period of time, but there are no lasting effects. As long as the horse does not continue to ingest buttercup, the symptoms will disappear within a day or two.

14. Ask the participants, "How might a small amount of toxin affect your animal?"

Poor production, slower growth rates, weakened immune systems, less energetic, decreased conception rates, decreased appetite and worse overall health.

15. **Bottle two:** Put four circular mints in the second bottle of diet soda and allow the participants to observe the reaction. The reaction should be an eruption that overflows/projects out of the bottle as the circular mints react with the soda. Read aloud or paraphrase the following:

If an animal is exposed to a large amount of toxic material, the reaction will be much more severe. When comparing the reactions of the four circular mints and the one circular mint in the diet soda, we can easily see that the four circular mints created a much larger reaction. This would be like a ram (male intact sheep) that ingests Japanese yew (an extremely toxic plant to mammals). When a ram ingests enough leaves from a Japanese yew to equal just 0.1 percent of its body weight, the ram would die from respiratory or cardiac failure within only 30 minutes of consumption.

16. Ask the participants, "What are some other substances that may be highly toxic to animals?"

Examples include:

- *General: Bleach, disinfectants, extremely poisonous plants (Japanese yew), pesticides, pest control substances (rat poison), any additional chemicals could animals ingest*
- *Equine: creeping charlie*
- *Cattle: wild onions*
- *Sheep: white sweet clover*
- *Swine: lamb's-quarters*
- *Goats: dogbane*
- *Poultry: black locust*
- *Rabbits: white snakeroot*

17. Ask the participants, "What are some ways that you could prevent your animal from coming into contact with highly toxic substances?"

Locks on cabinets that contain chemicals (such as cleaning supplies), walking pasture and removing any poisonous plants, keeping medicines, feed and chemicals in separate areas.

Image 3: A noticeable toxic effect takes place with one mint.

Image 4: Four mints cause a severe toxic effect with a large reaction coming out of the bottle.

18. To summarize, read aloud or paraphrase the following:

Toxic substances can be almost anywhere. Knowing what is potentially toxic to your animal and preventing it from being exposed to these substances is an important part of caring for your animal. Knowing what you need to provide your animal – such as adequate amounts of clean, fresh water and quality nutrients – and reducing the risk of exposure to toxic elements can keep your animals healthy and flourishing.

Once reactions have completed, use the paper towel to clean up the area. Dispose of all supplies in the trash bag.

ADAPTATIONS & EXTENSIONS:

For older or more experienced participants:

- Purchase enough supplies for the lesson so that small groups can each conduct the reactions.
- Have participants research a toxic material for an animal of their choice. Following their research, have the youth present their findings about the toxic element, explaining what it is, how an animal could become exposed to it, the effects of exposure, and how to reduce the risk of animal exposure to the material.
- Individually or as a group, have participants walk a pasture to see if they spot any plants or trees that are toxic to the animals inhabiting that pasture. If any are found, discuss the appropriate plan of action to reduce the risk of the species in that pasture coming in contact with the toxic plant.
- Lay out pictures, some of which display toxic materials and others that are non-toxic, and have youth identify which are toxic. Sources for pictures of toxic plants would be Michigan State University Extension, other reliable online sources, books that can be used for weed identification, other trusted printed material.
- Use multiple types of soda (examples: orange, Sprite or 7-up, root beer, etc.) for the activity. These represent different species of animals. Discuss the differences in the reactions between the types of soda. This represents how some species can be affected differently by toxins.

For younger or less experienced participants:

- To simulate a larger reaction, use four circular mints in a 2-liter bottle of soda.
- Provide examples of common household materials they will have likely encountered, such as bleach, to explain what could be toxic to animals. Additionally, provide household items that an animal may come in contact with that are nontoxic. Relate this back to the potential risk of animals becoming exposed to toxins and how you can recognize an object that may be of concern.
- Use fewer or simpler pictures of toxic and nontoxic materials for them to identify. Sources for pictures of toxic plants would be Michigan State University Extension, other reliable online sources, books that can be used for weed identification, other trusted printed material.

TALKING IT OVER:

Ask the participants the following questions:

- What are some possible toxic materials?
  Chemicals such as fertilizers, pesticides, cleaning products, etc.; plants, which vary depending on the species of animal; bacteria, which also vary greatly depending on the region, species of animal and class of bacterium.
- What are some ways you can reduce the risk of your animal encountering a toxin?
  Making sure chemicals are properly stored to keep animals out of them, checking pastures for toxic plants, keeping equipment and facilities clean to reduce the risk of toxic bacteria.
- Why is it important to reduce the risk of exposure to toxic elements to your animal?
  Reducing the risk of exposure to toxic elements will keep your animals healthy and able to grow, produce and perform with fewer potential problems.
- Are there things that are toxic to one species but not to another species?
  Yes. Though some materials are toxic to all mammals, others, particularly plants, will have a more severe impact on certain species than others.
- How can you learn more about things that are toxic to your animal?
  Research online about toxins and how they affect your animals, talk with your veterinarian about common toxins in your area, read books about toxins that commonly affect your animal species.

ALIGNMENT TO SCIENCE AND ENGINEERING PRACTICES:

How 4-H Increases Science Literacy

Nationally and in Michigan, 4-H has long enjoyed a reputation for engaging young people in positive, experiential (hands-on), and nonformal activities that are inquiry based. The activities in the *4-H Animal Science Anywhere* series can be used to enhance classroom science education. The activities are aligned with the eight Scientific and Engineering Practices from *A Framework for K–12 Science Education* (National Research Council, 2012, p. 42).

The activities in *4-H Animal Science Anywhere: Toxicology* were evaluated for their alignment with the Science and Engineering practices by Michigan State University (MSU) Extension Educator Tracy D'Augustino in 2016.

Table 3. How This Lesson Aligns With the Science and Engineering Practices (National Research Council, 2012, p. 42)

Science & Engineering Practice	Action	Activity Step
▸ Asking questions and defining problems	▸ Participants brainstorm examples of toxic materials. ▸ Participants brainstorm ways animals can come into contact with toxins.	16, Talking it Over
▸ Developing and using models	▸ Participants learn what each part of the model represents. ▸ Participants observe the model to learn about the effects of toxins ingested by animals.	2, 3, 11 6, 7, 8, 9, 10, 13, 15
▸ Planning and carrying out investigations		
▸ Analyzing and interpreting data	▸ Participants discuss why it is important to use preventive methods to reduce the risk of exposure to toxins.	14, Talking it Over
▸ Using mathematics and computational thinking		
▸ Constructing explanations and designing solutions	▸ Participants obtain evidence from their discussion to answer what preventive strategies can be taken to reduce exposure to a toxin. ▸ Participants discuss some potentially toxic materials. ▸ Participants communicate why some species are more affected than others.	17, Talking It Over 12, 16, Talking It Over Talking it Over
▸ Engaging in argument from evidence	▸ Participants explain the issue of animals coming into contact with toxins. ▸ Participants learn about the importance of a well-balanced diet. ▸ Participants learn about the importance of access to clean water.	14, Talking It Over 6, 7 8, 9, 10
▸ Obtaining, evaluating and communicating information	▸ Throughout the lesson, participants learn about how and why toxins can be detrimental to animals. ▸ Participants learn prevention strategies and can communicate with one another why these strategies are important.	Whole lesson 17 and Talking It Over

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ACKNOWLEDGMENTS:

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Produced by ANR Communications and Marketing for MSU Extension (http://msue.anr.msu.edu/). 1P–09:2017-WEB–LJ/MR WCAG 2.0