



On-farm slaughter operation food safety

Learning module 1:

Food safety hazards and controls

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Contents

On-farm slaughter operation food safety learning modules	4
Learning Module 1: Food Safety Hazards and Controls	4
• 1.0 Introduction to food safety	4
• 2.0 What is a food safety hazard?	4
• 2.1 How are food safety hazards controlled?	4
• 3.0 Biological hazards	5
• 3.1 Growth of bacteria in meats	5
• 3.2 Controlling biological hazards	6
• 4.0 Chemical hazards	6
• 4.1 Controlling chemical hazards	6
• 4.2 Food allergens	7
• 4.3 Controlling allergenic hazards	8
• 5.0 Physical hazards	8
• 5.1 Controlling physical hazards	8
• 6.0 Quiz	8

On-farm slaughter operation food safety learning modules

Learning Module 1: Food Safety Hazards and Controls

1.0 Introduction to food safety

Food safety is a shared responsibility between government, food processors (including OFSOs) and consumers. Everyone that prepares food, including meat products, is responsible for the safety of the food being made for their customer(s). Food that is not prepared properly, improperly labeled, or mishandled can lead to a foodborne illness.

A foodborne illness, also called food poisoning, is caused when a person has consumed food, beverages or water that are contaminated with pathogenic (disease causing) bacteria, parasites, viruses, or other hazards. Bacteria, parasites, and viruses are mostly found in raw meats, including poultry, fish, and eggs, but they can also be found on fruits and vegetables, and spread to any type of prepared food. Additionally, food and meat products that have not been refrigerated, left outdoors, or stored too long before being used, can also cause food poisoning. Foodborne illness can also be caused when the person preparing the food has not washed their hands before preparing the food, from an improperly cleaned processing area, from pests, undeclared ingredients (e.g., allergens) or from improperly maintained food processing equipment.

Every year, more than four million Canadians get food poisoning. The most common symptoms can include general discomfort, stomach pain and cramps, headache, rash, nausea, vomiting, diarrhea, chills and fever. Additionally, food poisoning can cause long-term medical problems and complications, including death. Food poisoning symptoms can start within hours after eating contaminated food, but sometimes symptoms appear days or weeks later.

Adults aged 65 or older, children younger than five, pregnant women, people with chronic medical conditions or compromised immune systems, and people undergoing medical treatment are most susceptible to food poisoning.

Knowing what food safety hazards are, where they can be found in your slaughter environment or processing area, and controlling these hazards are important considerations for an on-farm slaughter operation.

2.0 What is a food safety hazard?

A food safety hazard is anything that has the potential to cause an undesirable health outcome (e.g., illness, death) for consumers. A food safety hazard(s) occurs when a food is exposed to the hazard which results in the contamination of the food.

There are four types of hazards found in a food processing environment:

- biological
- chemical
- allergens (considered a chemical hazard)
- physical

2.1 How are food safety hazards controlled?

Controlling food safety hazards requires understanding and awareness of where hazards can be found, and then the steps or actions required to remove or reduce the hazard. Hazards can be found in:

- raw ingredients (meat)
- added ingredients
- processing step(s)
- facility (processing or storage areas).

It is common to find one or more hazards in the different areas of your processing facility, and steps or actions are needed to control the hazard(s). Additionally, each processing facility and operation is unique, and the identification and control of hazards are specific to your operation. As you proceed through this learning module, control steps for each type of hazard

have been identified. Please note that the control steps identified for each hazard are not a complete list, and further steps or actions may be required to control the hazards associated with your facility and your operation.

3.0 Biological hazards

Biological hazards include pathogenic bacteria, viruses, and parasites, and can contaminate the carcass from:

- the environment (e.g., soil bacteria, agricultural run-off)
- poor slaughter and dressing techniques (e.g., improper hide removal)
- cross contamination during transportation to the processing area
- insufficient sanitation practices in the processing area
- processing activities (e.g., using dirty utensils or from dirty hands)
- poorly maintained storage areas (e.g., dirty storage areas)
- pests (e.g., rodents).

Common biological hazards in meat processing include:

- Pathogenic Bacteria: *Escherichia coli* (*E. coli*) O157:H7, *Salmonella* spp., *Campylobacter jejuni*, *Clostridium botulinum*, *Clostridium perfringens*, *Listeria monocytogenes* and *Staphylococcus aureus*
- Note: some food borne pathogens also produce toxins in certain environments—usually in processed, ready-to-eat (RTE) meat products. Toxins can be produced by *Staphylococcus*, *Bacillus* and *Clostridium* bacteria and are a major threat to consumer health and lead to economic losses.
- Viruses: hepatitis A virus, Norwalk virus and Rotavirus

Parasites: *Toxoplasma gondii*, *Cryptosporidia*, *Giardia* spp, and *Trichinella spiralis*

3.1 Growth of bacteria in meats

Bacteria can live in hotter and colder temperatures than humans, but they do best in a warm, protein-rich environment that is pH neutral or slightly acidic. There are exceptions of course, and some bacteria grow well in extreme heat or cold, while others can survive under highly acidic or salty conditions. Raw and processed meats are perfect environments for bacteria to live and grow. Most pathogenic bacteria grow fastest in the temperature range of 4°C/40°F to 60°C/140°F, which is also known as the danger zone.

There are conditions that can promote (better support) the growth of bacteria in a food. These conditions are:

- foods with a high protein content (raw and processed meat have a high protein content, so this a perfect environment for growth of bacteria)
- improper temperature – keep meat cold, less than 4°C/40°F to slow bacterial growth. Freezing stops bacteria from growing in meat (but does not kill bacteria)
- after a meat product has been heated to the appropriate temperature (e.g., cooking/smoking a ready-to-eat product), it must be cooled as soon as possible to less than 4°C/40°F after cooking because normal cooking does not kill all the bacteria.
- acidity, expressed as pH. Bacteria do not grow well in acidic foods with a pH of 4.6 or below.

What is pH? pH is a measure of how acidic or basic a food is. pH ranges from 0-14, with 7 being neutral (i.e., water). A pH of less than 7 indicates acidity, whereas a pH of more than 7 means basic.

- foods with a pH greater than 4.6. These are considered low acid foods (e.g., carcasses, raw meat cuts, and most ready to eat meats). Handling and processing of low acid foods requires knowledge and care to prevent the growth of pathogens.
- allowing time for the bacteria to grow (multiply). The longer bacteria are kept in the danger zone (between 4°C/40°F to 60°C/140°F), the more they will grow

oxygen – bacteria can have specific oxygen requirements for growth. Some only grow if oxygen is present, some can grow with or without oxygen (e.g., *E. coli*, *Listeria*, *Salmonella*, *Staphylococcus aureus*, and most spoilage bacteria), and some can only grow if there is no oxygen present (e.g., *Clostridium botulinum* in canned meats)

- moisture – the higher the water content of meat, the greater the chance of bacterial growth. Most raw and processed meat products have plenty of moisture (water) available to support bacterial growth

3.2 Controlling biological hazards

The most effective way to control biological hazards is to:

- identify which biological hazards might contaminate your meat,
- determine the steps needed to prevent the contamination (or limit the contamination), and,
- control the biological hazards that may be present using processing strategies.

Control of biological hazards can include:

- slaughtering practices that prevent and reduce bacterial contamination
 - refer to Module 4 – Safe poultry slaughter and Module 5 – Safe red meat slaughter
- using an effective heating process that cooks the meat product to an appropriate temperature (e.g., cooking, thermal canning) for an appropriate period
- using appropriate temperature controls (e.g., keeping the processing room cool during meat processing)
- storing raw and finished products separately
- storing meat and processed meat products at appropriate temperatures (e.g., cooler <4°C/40°F, freezer < -18°C/0°F)
- following processing limits (e.g., appropriate cooking times and temperatures, lowering of water activity (Aw), measuring pH)
 - Aw is a measure of how much water is available in a food for micro-organisms (biological hazard) to grow. If water activity is measured as low, then the ability for micro-organisms to grow is also low. Water activity can be measured with a water activity meter.
- effective cleaning and sanitation of the processing and storage areas
- implementing personal hygiene practices (e.g., handwashing, hairnets, clean clothing, food handlers free from illness etc.) to prevent cross contamination
- using potable (drinkable) water for processing and for cleaning
- using effective pest control devices to prevent entry of pests (i.e., rodents, insects, birds) into your facility. Pets are also a source of contamination and do not belong in the processing facility

4.0 Chemical hazards

A chemical hazard is any substance that can cause a health problem when consumed.

Common chemical hazards in meat processing can be:

- naturally occurring (e.g., mycotoxins or other natural toxins in plants)
- intentionally added (e.g., sodium nitrate in bacon, animal drug residues that have not withdrawn from the animal at the time of slaughter, food or colour additives used above normal usage levels)
- unintentionally added during processing (e.g., residue from sanitation, pesticides, or maintenance chemicals)
- food allergens

4.1 Controlling chemical hazards

The most effective ways to control chemical hazards is by identifying chemical hazards in your process or facility and ways to prevent these from contaminating your meat products. This can include:

- allowing an appropriate amount of withdrawal time prior to slaughter for any animals treated with drugs
- using potable water for cleaning
- using food safe chemicals and sanitizers
- following instructions for preparation and use of chemicals and sanitizers

storing chemicals separately from meat, ingredients, packaging, and food contact surfaces

- cleaning and removing chemical residues from food contact surfaces
- using food safe grease or lubricants
- not using excessive grease or lubricants on equipment

labeling chemical containers, measuring tools, and ensuring that these are only used for chemicals

On-farm slaughter operation | Learning module 1: Food safety hazards and controls

training any workers to follow safe handling and application procedures for sanitation, maintenance, or pesticide chemicals

4.2 Food allergens

A food allergy is when the immune system mistakenly treats something in a particular food (usually the protein) as if it is dangerous to you. Your body reacts to the allergen in the food by having an allergic reaction.

Symptoms of food allergies can include, but are not limited to:

- tingling in the mouth
- swelling of the tongue and throat
- nausea
- difficulty breathing
- chest pain
- hives
- rash
- itchy skin
- vomiting
- abdominal cramps
- loss of consciousness
- death

The symptoms occur because the body's immune system is reacting to a specific food or an ingredient in the food. Consumers with allergies must avoid allergens to prevent these potentially life-threatening symptoms.

A person can be allergic to any food, but some allergies are more common than others. Health Canada lists certain foods as "priority food allergens", as these foods are associated with 90 per cent of the allergic reactions in Canada.

In Canada, there are 11 priority food allergens:

- sulphites (a food additive) – do not cause true allergic reactions, but these are grouped with the priority allergens because sulphite-sensitive consumers may react to sulphites with allergy-like symptoms
- crustaceans and molluscs, – includes crab, lobster and shrimp, scallop and clams
- fish – examples include salmon, trout and anchovies
 - may be an ingredient in other products, such as sauces (i.e., Worcestershire sauce), that are added to a processed meat product
- eggs – including from chickens, ducks, geese, quail and other birds or fowl
- milk – some seasonings can contain milk
- mustard – includes mustard seeds (white, yellow and brown) and mustard greens
- peanut – are a member of the legume family and not related to tree nuts.
 - lupin, an ingredient used in gluten-free foods belongs to the same plant family as peanuts
- tree nuts – includes almonds, Brazil nuts, cashews, hazelnuts, macadamia nuts, pecan, pine nuts, pistachio nuts and walnuts
- sesame – seeds can be creamy white or charcoal black in colour
- soy – made from soybeans
- wheat and triticale – triticale is a hybrid grain created by crossing wheat and rye

Note: This list is periodically updated by [Health Canada](#) and it is your responsibility to be aware of any new priority allergens.

Allergens may be listed under other names on the label of an ingredient added to a processed meat product. Examples of allergens with other names on the ingredient list include egg, milk, wheat, crustaceans and molluscs, and wheat and triticale.

Food allergens can contaminate a meat product because:

- the ingredients were not listed or improperly listed on the label
- cross-contamination occurred during processing or storage

Note: It is important that all ingredients added to your meat product are listed in the ingredients of your processed meat product. Failing to do so may result in an allergic reaction, including death of the consumer.

In Canada, the most common reason for a food recall is due to undeclared allergens.

4.3 Controlling allergenic hazards

The most effective ways to control allergenic hazards is by identifying which allergens are in your facility and identifying controls to prevent these allergens from contaminating your food. This can include:

- using dedicated tools when handling allergens
- scheduling products that contain allergens at the end of the day or production run
- storing allergens to prevent cross-contamination of other ingredients (e.g., tightly closed containers, storing allergens underneath other ingredients, using a separate storage area)
- not purchasing ingredients from bulk bins due to cross-contamination from neighboring bins
- reviewing the label when purchasing ingredients to determine if the ingredient list has changed
- correctly labeling finished product with all ingredients
- thoroughly cleaning and sanitizing the production area, including equipment, after processing

The presence of undeclared allergens in your meat product creates a risk of life-threatening allergic reactions in people with allergies, and can also lead to costly recalls, which will impact your business and your reputation.

5.0 Physical hazards

A physical hazard is either a foreign item that has unintentionally contaminated a meat product (e.g., metal fragments in ground meat) or are naturally occurring (e.g., bones in meat) and are hazardous to the consumer.

Physical hazards are hard or sharp objects that can cause cuts to the mouth or throat, damage teeth or gums or damage the intestines.

Common physical hazards include:

- glass from light bulbs, glass containers or glass food containers
- hard plastic or ceramic items
- metal from equipment, broken needles, utensils, staples etc.
- stones or other debris from the slaughter environment
- wood splinters from wooden structures or wooden pallets
- naturally occurring parts of the food (e.g., bones)
- workers (e.g., false fingernails, jewelry)

5.1 Controlling physical hazards

Removing or reducing physical hazards is the most effective way of preventing physical hazards. This can include:

- using lamp covers or protective bulbs in the processing and storage areas
- not wearing jewelry or false fingernails when preparing processed meat products
- wearing hair nets and dedicated protective clothing in the processing area
- removing any non-essential items from the processing area: ceramic items, hard plastic or glass cups, writing utensils
- checking equipment before and after processing for broken, worn, or missing pieces or parts
- using a metal detector to detect metal pieces

6.0 Quiz

Please complete the **learning module 1: food safety hazards and controls** quiz.

For more information on the topics in this module, please contact agi.foodsafety@gov.ab.ca.