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Pre-Processing Handling in Broilers

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SUMMARY

INTRODUCTION
There are a number of factors during pre-processing handling that can potentially influence carcass quality. Understanding these provides the basis for good management and welfare practices, optimal carcass quality, and flock profitability.

FEED WITHDRAWAL
Feed withdrawal (the removal of feed to empty gastrointestinal tract [GIT] contents) reduces the risk of fecal contamination at the processing plant. Feed should be removed from the flock 8 - 12 hours before the expected time of processing. Water should be available continuously until catching.

The feed withdrawal process must:
- Be done in a balanced way, considering bird welfare at all times.
- Complement the normal eating pattern of the flock.
- Allow birds time to clean up all feed in the feeders.
- Allow the GIT to be emptied without excessive weight loss occurring.

CATCHING
During catching:
- Minimize light intensity and avoid sudden increases in light intensity.
- Control and adjust ventilation carefully to avoid heat stress.
- Catch birds with care, avoiding injury.

Clear guidelines must be in place and the catching process should be monitored and reviewed regularly. Appropriate personnel training is essential.

TRANSPORT
Transportation should be done using suitable vehicles which:
- Provide adequate protection from the weather and appropriate ventilation.
- Are within the local current guidelines or legislation.

During transportation:
- Use ventilation, extra heating and/or cooling when necessary.
- Minimize stops, transport distances, and transport time.
- Adhere to local current guidelines or legislation.

HOLDING
Upon arrival at the processing plant, birds need to be held in a cool, weather-proofed area. Humidity, temperature, and bird comfort should be routinely monitored, and holding time prior to slaughter minimized.

CONCLUSION
Correct pre-processing handling results in a successful transition from farm to processing plant: maximizing bird welfare, carcass quality, and flock profitability.

The remainder of this article provides more detail on the points summarized on page one.

INTRODUCTION

Pre-processing handling, the management of birds during the last 24 hours prior to slaughter, is a vital step in preparing for broiler meat processing. In this final stage of the broiler management cycle, the procedures put in place (feed withdrawal, catching, transportation, and holding) can substantially influence bird welfare, carcass yield and grade, and overall profitability.

FEED WITHDRAWAL

The purpose of feed withdrawal is to allow the contents of the gastrointestinal tract (GIT) to be emptied prior to processing. This reduces the risk of fecal contamination at the processing plant (**Figure 1**), resulting in better profitability, product safety and shelf-life. It also reduces the labor costs associated with re-processing carcasses to remove or clean contamination.

Figure 1: Clean birds showing no signs of fecal contamination on the processing line.

Feed withdrawal plans should be monitored and reviewed constantly and must be modified promptly if problems occur, but as a general rule of thumb, feed should be removed from the flock 8-12 hours before the expected processing time.

FEED WITHDRAWAL PERIOD

Time in the house without feed
+
Catching time
+
Transport time
+
Time in the holding (lairage) area prior to processing

The feed withdrawal process must complement the normal flock eating pattern, and consider bird welfare at all times. Prior to catching, birds must have sufficient time to clean up feed in the feeders, and to empty the contents of the GIT without incurring excessive pre-processing body weight loss. Routine monitoring of birds on the farm (for pre-processing weight loss), and at the processing plant (for pre-processing weight loss and crop fill, or any signs of fecal contamination) will ensure the feed withdrawal program is working effectively. Photos illustrating what the GIT should look like when feed withdrawal is optimized are given in **Appendix 1**.

The rate at which the contents of the GIT are cleared can be affected by:

- **Darkness**. The rate of GIT clearing is reduced in the dark. To achieve good GIT clearing, birds should receive light for at least 4 hours after feed has been withdrawn.
- **Placement of birds in transport modules**. The rate of GIT clearing decreases once birds have been placed in transport modules. Avoid placing birds in transport modules within 4 hours of feed being withdrawn.
- **Temperature**.
  --- Hot temperatures decrease feed intake but increase water consumption, affecting the consistency of fecal material, and increasing the rate of GIT clearing. During hot weather, the feed withdrawal period may need to be shorter.
  --- The rate of GIT clearing and the frequency of eating is decreased at cold temperatures (below 16°C [60°F]). In cold weather, the feed withdrawal period may need to be longer.

Water must be available continuously until the point of catching. Without water, birds may become dehydrated and the GIT will not be emptied. However, if prior to catching, birds are without feed for more than 5 hours, water consumption will be increased, thus increasing the water content of the GIT and the risk of carcass contamination at the processing plant.

During feed withdrawal, leaving the feeders down until the catching crews arrive may help to reduce litter eating. Once feed has been depleted, birds will then peck at the feeders rather than the litter.

After feed withdrawal has started, it is important to avoid disturbing the flock (e.g. excessive walking of the house or opening of doors).

Feeding patterns and feed withdrawal

A flock of birds will normally develop a well-defined pattern of feed consumption. Broilers in a comfortable environment, with constant access to feed and water, will eat and drink at a steady rate throughout the day - eating approximately every 4 hours and drinking several times during that 4-hour feeding cycle. Feed consumption patterns should not be altered in the last few days, and more importantly, during the last 24 hours prior to transportation. If normal feeding patterns become disrupted, aggressive and uncontrolled eating may develop, particularly if birds are without feed for a prolonged period of time. Uncontrolled eating results in an unpredictable clearing of the GIT that will increase the risk of fecal contamination during processing.

Feeding patterns are affected by a number of factors and these factors must be taken into account when considering appropriate feed withdrawal periods.

- **Feed availability.** If feed amount and feeding space are not adequate, competition increases for feed and feeding space which will affect feeding patterns.
- **Light.** Birds adapt feeding patterns to the lighting program they are on. Birds stop eating in the dark. If a lighting program is used, and dark periods are excessive, birds will eat larger quantities of feed when it becomes available (compensatory eating). The longer the lights are off, the more severe compensatory eating will be. As all birds will want to eat at the same time when the lights come on, normal feeding patterns may be further disrupted due to over-crowding at the feeders. Provision of adequate feeding and drinking space is critical when lighting programs are implemented.
- **Temperature.** High environmental temperatures reduce feed intake, while low environmental temperatures may result in uncontrolled eating.

Assessing the crop fill of 20-30 birds prior to shackling is a useful means of determining whether or not alterations in feeding pattern have occurred. If, at shackling, more than 10% of the sample is found to have full crops or large quantities of feed in the crop, it is likely that feeding patterns have been disrupted, and that feed withdrawal has been inappropriate. Investigations into the reasons for this should take place.

Pre-processing weight loss

Some weight loss will occur during feed withdrawal due to removal of GIT contents. However, once the GIT is completely empty of feed, the rate of weight loss increases as body reserves of fat and protein (muscle) are mobilized to support metabolism (a process known as pre-processing weight loss or 'live-shrink"). Excessive feed withdrawal time can have a negative impact on carcass yield, carcass quality, and profitability. Feed withdrawal must provide a balance between achieving good food safety and avoiding excessive weight loss.

Once the GIT is completely empty, pre-processing weight loss figures typically range from 0.1-0.5% loss in body weight per hour. The exact amount of weight loss that occurs will vary depending on:

- **Bird age**. Weight loss will be higher in older birds.
- **Sex**. Weight loss will be higher in males.
- **House temperature**. Weight loss will be increased in extremes of temperature (both high and low).
- **Eating patterns before feed withdrawal**. If eating patterns are altered or interrupted prior to feed withdrawal variability in GIT contents among birds will be increased.
- **Length of time in transport modules**. The more time spent in transport modules, the higher the weight loss will be.
- **Holding temperature**. Higher holding temperatures lead to increased weight loss.

EXAMPLE

Effects of pre-processing weight loss on profitability.

Assumptions:

Processing age = 42 days
Body weight = 2768 g
Number of birds processed per week = 1 million
Meat value = $1.00/kg live weight

With no pre-processing weight loss each bird would be valued at $2.77.

If birds were left for only **1 hour** without any feed after the GIT has been completely emptied, each bird would be estimated to lose 0.3% (or 8g) of its live weight and would therefore weigh 2760g.

Each bird has a reduced valued at $2.76.

A total loss of **$10,000/ week.**

A simple and effective method for calculating pre-processing weight loss is to mark and weigh a sample of 20-30 birds at each stage of the pre-processing handling procedure (following the same birds all the way through):

- **Preparation** (including feed withdrawal) **to catching**. Weigh birds about 4 hours prior to catching.
- **Catching to transport**. Weigh birds just before the truck leaves the farm.
- **Transport to holding**. Weigh birds on arrival at the processing plant.
- **Holding to processing.** Weigh birds just prior to shackling.

If weight loss is higher than expected at any point in the process (based on historical records), the reasons for this should be investigated, and the feed withdrawal program appropriately modified.

CATCHING

Bird stress during catching should be minimized. Light intensity should be reduced to a minimum, and any sudden increases in light intensity avoided. When catching is conducted during daylight hours, the use of curtains over the main doors will help to minimize light intensity in the house and reduce stress.

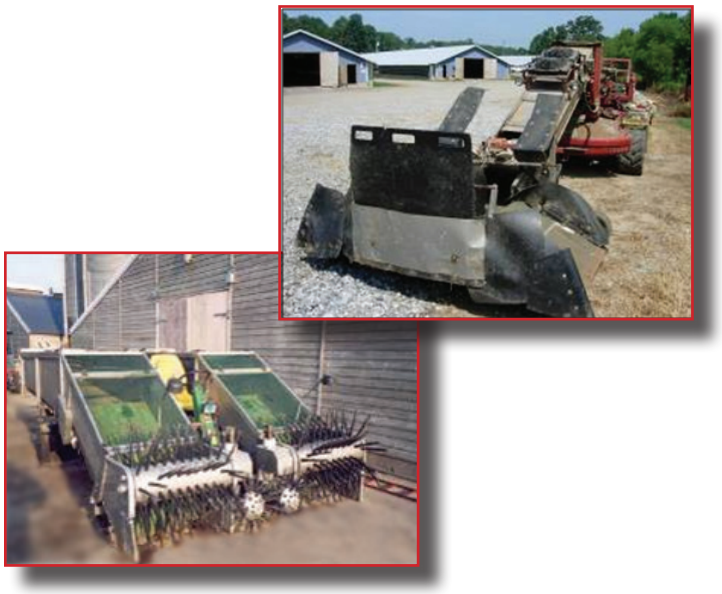
Ventilation must be controlled and adjusted carefully during catching to avoid heat stress, and birds should be monitored closely for any signs of over-heating (panting).

Catching can be completed manually or mechanically. With mechanical catching (**Figure 2**) 4,000-5,000 birds an hour can typically be caught. The potential benefits of mechanical catching (when properly managed according to manufacturer recommendations and with appropriate training) are:

- Improved bird welfare through decreased catching stress and injury rates.
- Lower operating costs.
- Improved working conditions.

However, the initial set-up costs of mechanical catching are high, and it is not suitable for use in all operations. Mechanical catching is best suited to modern facilities where houses tend to be wider and are clear span (free from internal structural obstructions).

Figure 2: Examples of mechanical harvesters.



Methods of manual catching vary from country to country depending on equipment and labor availability. Manual catching crews typically catch and crate between 7,000-10,000 birds an hour. However, personnel can be subject to fatigue and may perform inconsistently during a shift. The use of forklift trucks to bring transport modules into the house, or PVC pipes to aid movement of transport modules through the house (**Figure 3**), can make manual catching easier.

Figure 3: Using a forklift or PVC pipes to ease manual catching.

Catching crews must be properly trained in bird handling and welfare. Birds should be caught carefully, and held by both shanks, or by the breast with both hands to minimize distress, damage, and injury (e.g. bruising or hip and wing dislocations). Clear guidelines on bird handling must be in place and the catching process should be monitored and reviewed regularly.

The most common lesion associated with mishandling during catching is bruising. Around 90-95% of the bruises found on broilers at processing occur during the last 12 hours prior to slaughter. Of these, typically 35% are caused by the grower, 40% occur during catching, and the remainder occur during transport, unloading and shackling.

Analyzing the color of any bruising seen in the processing plant to determine their age (see **Table 1**), and therefore at what point in the process they occurred, is a useful means of establishing where problems exist, and if any additional training is required.

Table 1: Changes in bruise color with time.

TIME	COLOR
Minutes	Red
12 hour	Dark red - purple
24 hour	Light green - purple
36 hour	Yellow, green - purple
48 hour	Orange
72 hour	Yellow - orange
96 hour	Slight yellow
120 hour	Normal color

Based on original work by Hamdy et al, 1961

Having a member of staff from the processing plant monitoring the catching process may also be a worthwhile exercise.

Bruises are occasionally attributed to mycotoxins (e.g. aflatoxin). However, aflatoxin only increases the susceptibility to bruising, it does not cause it. Bruising only occurs as a result of some sort of trauma/mishandling.

Transport modules should not be overfilled, and local legislation must be adhered to. If the number of birds per module is too high, over-heating, increased bird stress, mortality, and a higher incidence of condemnations at the processing plant may occur. The number of birds per transport module must be reduced in high temperatures (the exact level of reduction is difficult to quantify and will depend on the temperature, the size of the transport module, and local legislation policy).

TRANSPORT

Transportation vehicles (**Figure 4**) must provide adequate protection from the weather, appropriate ventilation, and comply with local current legislation.

Figure 4: Example of a vehicle suitable for transporting broilers to the processing plant.

The micro-climate inside the bird compartment of the truck will be different to the temperature and humidity outside, and could be detrimental to the birds. This is especially true when the vehicle is stationary. Ventilation and extra heating and/or cooling should be used when necessary. Stops during transportation should be minimized.

If the weather is hot, transportation during the night is preferred and the use of fans to keep air circulating through the modules should be considered. Allowing at least 10 cm (4 in) between every 2 tiers of transport modules, or introducing empty transport modules at regular intervals throughout the load, will improve air-flow and can reduce heat stress.

In cold weather, the load should be covered to minimize chill, and bird comfort should be checked.

Long transport times can increase the number of birds being dead on arrival (DOA) at the processing plant. When transporting birds, seek to minimize transport distances and operate within local legislation guidelines. The transport route must be planned in advance, and the transportation schedule adhered to.

HOLDING

Upon arrival at the processing plant, birds need to be held in a cool, weather-proofed area (**Figure 5**). Humidity, temperature, and bird comfort should be monitored on a routine basis. If birds are observed huddling (cold distress) or panting (heat stress), then environmental conditions are not optimal and should be altered immediately.

Figure 5: A holding area at a processing plant.

Fans can be used to help keep the birds cool and well ventilated in the holding area (**Figure 6**). Fans should be positioned carefully to ensure a good, even airflow through the crates. Appropriate spacing between the trucks, or inserting empty modules into the bird compartment of the truck, will help improve air-flow around the birds.

Figure 6: Fans being used in the holding area to keep birds cool.

During periods of high temperature, foggers can be used to help keep birds cool. Foggers must be well-maintained, and should not be used when relative humidity is greater than 70% because the capacity of birds to lose heat will be compromised. If foggers are used, it is important to make sure birds are dry when placed on the processing line. If birds are wet, the effectiveness of the electrical bath stunner may be reduced - compromising bird welfare and carcass quality.

During periods of cold weather, it may be necessary to provide extra heating in the holding area. Adequate ventilation must be maintained at all times.

Holding times at the processing plant should be minimized and birds processed as quickly as possible. Excessive holding periods compromises carcass quality and more importantly, bird welfare.

CONCLUSION

Pre-processing bird management can have a significant impact on bird welfare, food safety, and profitability. It is important to achieve a clear understanding of how to manage birds during the 24 hours prior to processing through:

- Applying good feed withdrawal practices to prevent fecal contamination at the processing plant and minimize the effects of pre-processing weight loss.
- Catching should be done with care to avoid injury and also quickly and efficiently, to minimize the time taken to transport the birds to the processing plant.
- Transport vehicles must provide birds with the appropriate protection and ventilation to minimize stress.
- Holding time at the processing plant should be kept to a minimum and proper environmental control in the holding area is critical.

All stages of pre-processing management should be monitored and reviewed regularly to ensure it remains efficient while maintaining bird welfare.

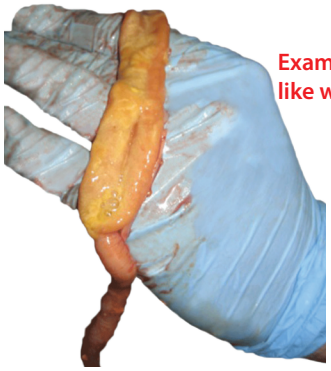
Following the guidelines described in this article can help achieve a successful transition from farm to processing plant, maximizing bird welfare, carcass quality, and flock profitability.

APPENDIX 1

Effects of feed withdrawal time on the gastrointestinal tract seen at processing.

Optimum Feed Withdrawal Time (8-12 hours)

- Empty crop.
- Empty proventriculus.
- Empty gizzard (about 30% of birds may have a small amount of dry feed present).
- Flat intestines with preserved structure containing a small amount of gas.

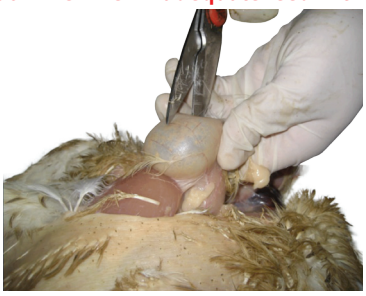


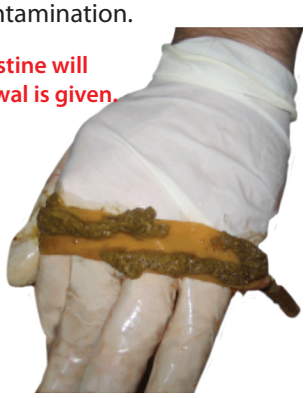
Example of what the small intestine will look like when optimal feed withdrawal is given.

Inadequate Feed Withdrawal Time (less than 7 hours)

- Full crop.
- Full proventriculus.
- Full gizzard.
- Rounded intestines full of feed.
- Upon evisceration, duodenal loop is positioned close to where the vent is opened, and is easily cut during vent opening – resulting in carcass contamination.

Example of what the crop and small intestine will look like when inadequate feed withdrawal is given.

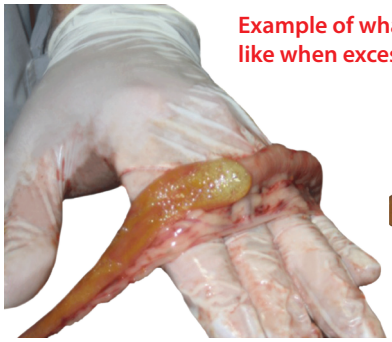




Excessive Feed Withdrawal Time (more than 13 hours)

- Empty crop (may be stained with gall). Can adhere to the carcass in some cases.
- Empty proventriculus (may be stained with bile).
- Gizzard full of litter, feed, feces (may be stained with bile).
- Darker liver color.
- Enlarged gall bladder.
- Weak, thin intestines with sloughing of the mucosa and excess gas.
- Increased risk of intestinal tearing. Higher risk of microbial contamination (e.g. Salmonella spp.).

Example of what the small intestine will look like when excessive feed withdrawal is given.



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