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# Livestock Handling at the Abattoir: Effects on Welfare and Meat Quality

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**Abstract:** Low-stress handling that uses behavioral principles can help reduce bruises and improve meat quality in cattle, pigs, and sheep. Short-term stressors before stunning, such as electric prod use or jamming in the race, may increase Pale, Soft, Exudative meat in pork and reduce tenderness in beef. Longer term stresses may increase Dark, Firm and Dry meat. Continuous assessment of livestock handling practices is recommended. Handlers should be trained to move small groups of livestock. They also need to understand behavioral principles. The most important ones are flight zone and the point of balance at the shoulder. Calm animals will be easier to handle. Simple economical improvements in races and lairages can help facilitate animal movement through the facility. The movement of livestock can often be improved by (1) installation of a light at a dark stun box entrance, (2) moving lamps to reduce reflections on shiny metal, (3) installation of solid shields to prevent incoming animals from seeing people on moving conveyors, (4) redirection of air flow at the stun box entrance, or (5) in elevated conveyor restrainers, use of a false floor to prevent entering animals from seeing the "visual cliff" effect. Continuous assessment and supervision are required to maintain low-stress handling methods.

**Key words:** welfare, handling, cattle, pigs, meat quality, slaughter
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## Introduction

Low-stress livestock handling at the slaughter plant has the benefit of improving both animal welfare and meat quality. Resting pigs in the lairage for 2 h before stunning, and reduction of electric prods (goads), is especially important to preserve meat quality (Milligan et al., 1998; Warriss, 2003; Hambrecht et al., 2005a). Short-term handling stresses a few minutes before stunning can increase Pale, Soft, Exudative (PSE) pork in pigs (Hambrecht et al., 2005a; Hambrecht et al., 2005b) and tough meat in beef (Warner et al., 2007). High-stress handling methods will increase lactate in the blood (Benjamin et al., 2001; Hambrecht et al., 2005a; Edwards et al., 2010a; Edwards et al., 2010b; Rocha et al., 2016). This results in lower pH in the meat, and it may make beef tougher (Gruber et al., 2010). When glycogen is depleted, lactic acid can no longer be produced. This results in higher than normal ultimate pH.

Longer term stresses, such as temperature fluctuations 24 to 48 h before slaughter or long transport times, deplete the stores of muscle glycogen and may increase Dark, Firm and Dry (DFD) meat (Jones and Tong, 1989; Scanga et al., 1997; Gallo et al., 2003). A basic principle is that handling stresses that occur shortly before stunning increase lactate and lower pH. Animals subjected to long-term stress may have higher pH and DFD meat (dark cutter). There are exceptions to this rule, but the principle of a short-term stress versus a long-term stress is a concept that is easy to understand. It will assist abattoir managers in solving meat quality problems, because long-term stresses are more likely to occur outside the abattoir.

Both PSE in pigs and DFD beef in cattle are severe quality defects. PSE pork has poor water binding capacity and higher cooking losses (Van der Wal et al., 1988). DFD beef and pork have a shorter shelf life (Blixt and Borch, 2002). The shorter shelf life is due to higher pH favoring microbial growth. Meat that is DFD is darker and firmer. Other topics that will be covered in this review will be methods for reducing bruises and quality problems such as petechial hemorrhages (blood splash). Both of these problems may be related to handling methods. The main emphasis of this paper will be on improving handling practices in the abattoir. There will also be a short discussion of on-farm factors outside the abattoir that may increase handling problems in the slaughter plant. Stress in a slaughter plant is often due to the novelty of the new environment (Kilgour and deLangen, 1970; Grandin, 1997; Deiss et al., 2009; Bourquet et al., 2010). Animals with more reactive genetics will have a bigger reaction (Bourquet et al., 2010). These reactions may be affected by both genetics and how the animals were handled on the floor.

## Effect of Poor Handling Practices on Short-Term Measures of Stress

### *Electric prods (goads) and other aversive handling events*

Several studies have clearly shown that use of electric prods is associated with higher lactate and cortisol levels in pigs and cattle (Benjamin et al., 2001; Hambrecht et al., 2005a; Hambrecht et al., 2005b; Edwards et al. 2010b; Hemsworth et al., 2011). Edwards et al. (2010a, 2010b) observed pigs being handled in a single-file race that led to the stunner. Pigs that were poked with an electric prod or became jammed in the race had higher lactate levels at exsanguination. Lactate in the blood can be easily measured with a handheld meter (Burfield and Heuwieser, 2012). Lactate levels can be used as a measure of the quality of handling shortly before stunning. After gentle handling, average lactate levels were only 4 mmol/L, and they rose to 25 mmol/L after high-stress handling (Benjamin et al., 2001). The abattoir where Edwards et al. (2010a) conducted her observations worked hard to reduce electric prod usage, and her highest lactate level was only 9.9 mmol/L. Pigs that were captive bolt stunned in a group pen at a small abattoir had very low lactate levels that ranged from 1.2 to 3.2 mmol/L (Schaeperkoetter, 2019). The low levels may also be due to prompt exsanguination when the pigs were still lying on the floor. No electric prods were used in the lairage, race, or the stunning box in this small abattoir. In all of the aforementioned studies, blood samples were collected within 15 min after an aversive handling event was observed.

### *Animal behavior and physiology shortly before stunning*

Behavioral signs of agitation, such as vocalization during handling or agitated behavior (jumping or hitting fences) are associated with physiological measures of stress in pigs and cattle (Dunn, 1990; Warriss et al., 1994; Gruber et al., 2010; Hemsworth et al., 2011). Grandin (1998a, 1998b, 2001) and Bourquet et al. (2012) studied vocalization in cattle shortly before slaughter. It was associated with obvious aversive events such as electric prods, excessive pressure from a restraint device, falling down, or gates being slammed on the animals. Reducing pressure applied by a head restrainer reduced the percentage of bovines vocalizing from 0% to 23% (Grandin, 2001).

### *Assessment of handling and restraint practices with outcome measures*

Animal-based outcome measures can be used to monitor the quality of cattle and pig handling shortly before stunning. Regular assessments by the quality assurance staff can help managers determine whether handling or restraint practices are becoming better or slowly deteriorating. Poor practices such as excessive electric prod use may slowly increase unless handling is continuously monitored. The handling measures that can be quantified are (1) percentage of animals falling down during handling (Grandin, 1998a; Welfare Quality Network, 2009; Grandin, 2010), (2) percentage of animals moved with an electric prod (Grandin, 1998a), and (3) percentage of pigs or cattle that vocalize during handling (Grandin, 1998a; Grandin, 1998b; Grandin, 2001; Losada-Espinoza et al., 2017). Each animal is tabulated as either silent or vocalizing. All cattle that vocalize in either a stun box or religious slaughter restraint box are counted. Abattoirs with both low-stress handling methods and careful operation of cattle restraining devices can have vocalization scores of 5% or less of the cattle (Grandin, 2005; Grandin, 2012). When the cattle are either repeatedly electrically prodded or held in a poorly designed restraint device, vocalization percentages can rise to 23% (Grandin, 2001) or even 26% (Grandin, 1998b). Hayes et al. (2015) reported vocalization percentages that rose to 47%. In an abattoir, it is easy to quantify the percentage of individual cattle

vocalizing. In large abattoirs, the author has observed that it is often difficult to accurately count the number of individual pigs that vocalize. There are species differences between sheep and cattle. Cattle or pigs will vocalize (moo, bellow, squeal) in direct response to an aversive event such as an electric prod. Sheep will remain silent. Vocalization in sheep occurs when they are either isolated from other sheep or recently weaned from their mothers. When sheep are handled in a slaughter plant, they become more stressed when isolated (Kilgour and de Langen, 1970; Bates et al., 2014).

## Long-Term Stresses, Bull and Steer Behavior, and DFD

When the glycogen in the muscle is depleted, an animal is more likely to have DFD meat. In Ghana, a combination of both poor transport and abusive handling can result in high percentages of cattle with DFD meat (Frimpong et al., 2014). Bulls will often have a greater percentage of dark cutters compared to steers (Price and Tennessen, 1981). Bulls have a greater tendency to fight than steers (Tennessen et al., 1985). Mixing bulls from different pens on the farm will increase fighting (Tennessen et al., 1985). The physical exertion of fighting depletes glycogen. Bulls that are fed together with their penmates on the farm should be transported with their penmates and then penned in the abattoir with their penmates (Grandin, 2014). In European abattoirs, bulls are often unloaded directly into single-file races to prevent fighting. Each bull is held in the race between 2 sliding gates that form an individual pen. This system is used to prevent fighting. Fighting resulted in more DFD beef. It is the author's opinion that for optimal animal welfare, bulls that are lairaged in single-file races should be delivered on a "just in time" basis. They should spend only a few hours in single-file races. From an animal welfare standpoint, the best way to manage fed bulls is to raise them on the farm and transport and lairage them in the same group of familiar penmates. When the groups are formed on the farm, the bulls will fight. When mixing is done early in the feeding period, the bull's physiology will have sufficient time to recover from the stress of fighting. After the bulls have formed a stable dominance hierarchy, they will no longer fight.

## Basic Facts About Bruises

Bruises on livestock cause huge losses to the livestock industry in many countries (Harris et al., 2017; Grandin, 2017). Training of employees in low-stress handling practices will reduce bruises (Grandin, 1981; de Costa et al., 2014). In cattle, bruises can occur after captive bolt stunning and before bleeding (Meischke and Horder, 1976). Strappini et al. (2013) reported that the stun box door hitting the backs of the cattle caused many bruises. Exact aging of bruises is difficult, but it is easy to determine a fresh bruise from a bruise that is several days old. Fresh bruises in cattle will be red (Hamdy et al., 1957), and older bruises in cattle or lambs over 48 h old may be darker or have yellowish mucous on them (McCausland and Dougherty, 1978). Strappini et al. (2009) and Mendonça et al. (2019) have good reviews of aging bruises in cattle. Betancourt-Garcia et al. (2019) found that either poor handling or poor loading facilities at the ranch of origin increased bruising. Additional handling procedures at auctions for disease testing may increase bruises on cows (Hoffman et al., 1998). In pigs, visual appraisal of skin lesions was not very accurate for determination of the age of the lesions (Vitali et al., 2017). A more accurate method for determining lesion age in pigs was a spectrophotometer (Vitali et al., 2017).

There are a number of different scoring tools available for quantifying bruises on cattle (Anderson, 1978; Strappini et al., 2013; Lee et al., 2017; Kline, 2018). When bruise prevalence is being compared between different abattoirs, it is strongly recommended that the same scoring tool be used. Some people working under commercial conditions do not know that using the same scoring tool is important. Visual assessment of bruises prior to trimming may miss internal deep damage. Kline (2018) found that some bruises have an "iceberg effect." The damage visible on the surface may be very slight, but when the bruise is trimmed, extensive damage is hidden underneath the surface. There is also a type of bruise that can occur on sheep that does not occur in other species. Sheep can be severely bruised if they are grabbed or picked up by the wool (Richardson, 2002).

## Blood Splash (Petechial Hemorrhages) Damage the Appearance of Meat

Both stunning and handling methods can have an effect on blood splash in meat of both pigs and sheep (Burson et al., 1983; Gregory, 2005). Poor handling

methods and electric prod use can increase blood splash in pigs (Calkins et al., 1980). The use of a group handling system and elimination of electric prods reduced blood splash in pigs that were stunned with $CO_2$ (Franck et al., 2003). It is beyond the scope of this paper to discuss the extensive research that has been conducted on stunning methods and meat quality. The author has observed that electric prod use and excessive pressure from a restraint device will increase blood splash in kosher-fed steers and heifers. These animals were slaughtered without stunning. This review will be limited to handling methods in the abattoir.

## Methods to Improve Handling and Restraint at the Slaughter Plant

### *Train people*

Training employees in low-stress livestock handling methods can reduce bruises and electric prod use (Grandin, 2005). de Costa et al. (2014) and Coleman et al. (2012) have shown that improving employee attitudes toward the animals improved handling. Following are simple steps to improve animal handling.

### *Greatly reduce electric prods*

Their use should be limited to the stun box entrance in systems in which single-file races are used. Electric prods can be completely eliminated when animals are stunned in groups (Barton-Gade and Christensen, 2002). Stunning in groups is used for $CO_2$ stunning in large pork plants or for either captive bolt or electric stunning in very small sheep or pork plants. An electric prod must not be constantly carried. It should be stored in an easily accessible place and only picked up to use on an animal that refuses to enter the stun box or restrainer. After use, it should be put away. The author has observed in many abattoirs that when people always carry electric prods, they will constantly use them. Electric prods or driving aids must never be applied to sensitive parts of the animal such as the eyes, anus, genitals, or udder (NAMI, 2019; OIE, 2019a; OIE, 2019b). Ritter et al. (2009) reported that in pigs, 2 shocks from an electric prod compared to 0 shocks resulted in higher blood lactate and rectal temperature. The OIE (2019a, 2019b) recommends avoiding the use of electric prods on sheep.

### *Use behavioral principles of livestock handling*

There are many resources in both the academic literature and livestock industry literature for training people on the use of behavioral principles of handling animals. Two of the most important principles that people need to understand is how the flight zone and point of balance effect the movement of livestock (Kilgour and Dalton, 1984; Smith, 1998; Grandin and Deesing, 2008; Grandin, 2014). Handlers who learn how to position themselves when moving cattle, pigs, or sheep will reduce stress on both themselves and the animals. When extensively raised cattle or sheep are being handled, the animals will usually remain quieter when handlers understand behavioral principles. Cattle rearing up in a single-file race will often stop rearing if the handler backs up outside the animal's flight zone.

### *Move small groups*

To achieve careful, calm handling requires the movement of small, separate groups of cattle and pigs. This will require more walking back and forth between the lairage and the crowd pen area that leads to the single-file race. The correct number of pigs or cattle to bring up at one time will vary depending on the facility design. A basic rule is to never fill drive alleys and crowd pens completely full. Animals have a natural behavior to turn around and attempt to return to the lairage (Grandin, 2014; Hutson, 2014). If the crowd pen or drive alley are completely filled, it may become extremely difficult to reorient animals in the right direction. There is a species difference between sheep and other livestock. Sheep have more extreme flocking and following behavior (Hutson, 2014). They can be moved in continuous flow in high-speed abattoirs because they keep following and moving.

### *Never drag animals*

Conscious animals that have fallen down or have become nonambulatory must never be dragged. They should be stunned prior to dragging. Mechanically powered gates must never be used to knock animals down or drag animals (NAMI, 2019).

## Design of Lairages (Stockyards)

There should be sufficient space in the lairage for all animals to lie down at the same time. This can be determined by observing pigs or cattle when they are all lying down. Kline et al. (2019) contains photos of

an overstocked and a correctly stocked lairage after all the cattle laid down. Lairages should also be equipped with water troughs (Welfare Quality Network, 2009; NAMI, 2019). Resting pigs in the lairage for 1 to 4 h will improve pork quality (Milligan et al., 1998). There are many methods to make floors nonslip. Some examples of nonslip flooring in lairage pens are grooved concrete or epoxy grit finishes. In high-traffic areas, such as unloading ramps and other high-traffic areas, steel bars or rubber mats may be used. Assessment of slips and falls is strongly recommended (Welfare Quality Network, 2009; Grandin, 2010). Scoring slips and falls will enable managers to determine whether slips and falls are improving or becoming worse. Rocha et al. (2016) reported that drip loss in pork was correlated with slips during unloading. Sharp edges can cause bruises. A smooth rounded surface will not case a bruise. Edges on angle irons or I-beams can bruise. If livestock are hitting a sharp metal edge, the metal may be shiny or have tufts of hair on it.

## Simple Changes in Facilities to Improve Movement into Stun Boxes and Restrainers

Electric prod use can often be greatly reduced by stopping strong air movement that blows into an animal's face when it enters a stun box or restrainer (Grandin, 1996; Grandin, 2014). Funnel-shaped crowd pens work effectively for cattle and sheep (Grandin, 2014; Grandin, 2015), but they work poorly for pigs (Hoenderken, 1976). A single offset step prevented pigs from jamming (Grandin, 1982). A single-file race must never be bent too sharply where it joins the crowd pen (Grandin, 2014) because bending it too sharply will create a dead-end effect, and animals may refuse to enter.

When new stainless steel equipment is ordered, the metal fabricator should be instructed to provide a dull, nonshiny surface. Moving lights or removing lights can sometimes eliminate reflections on shiny metal or a wet floor (Grandin, 1996; Klingimair et al., 2011). All species may refuse to enter a dark stun box or restrainer. Experimentation with portable lights to illuminate the entrance may facilitate entry for all species. The lamps should be positioned to provide indirect lighting. Illumination will facilitate animal movement from a darker to a brighter place (Van Putten and Elshof, 1978; Grandin, 1982; Grandin, 1996; Tanida et al., 1996; Grandin, 2001). Adding a light to a restrainer entrance reduced vocalizations from 8% of the cattle to 0% because electric prod use was reduced (Grandin, 2001). Addition of green lighting may reduce reflections (Eyes on Animals, 2015).

Addition of a solid panel prevented approaching animals from seeing people or moving conveyors, which often facilitated forward movement. Experimentation with large pieces of cardboard can be used to determine the best position for solid panels (Ecolano, 2018). Müller et al. (2008) reported that cattle remained calmer when a solid panel was installed to prevent them from seeing a person close to them. Animals will stop and refuse to move when they see small things that people do not notice. Some examples of small distractions that may need to be removed are paper towels hanging down, a coat on a fence, a hose on the floor, or a small piece of metal that moves (Grandin, 1996). Sudden intermittent noise is stressful to livestock (Stermer et al., 1981; Talling et al., 1998; Lanier et al., 2000). High sound levels may increase the risk for PSE pork (Vermeulen et al., 2016). Air exhausts should be muffled to prevent sudden loud hissing.

## Remedies for Problems with Stun Boxes, Head Holders, and Restrainer Conveyors

In pigs or cattle, vocalization is often caused by excessive pressure applied by a head holder or other mechanical restraint device (Grandin, 1998a; Grandin, 2001; Bourquet et al., 2012). Pressure-limiting devices may need to be installed if the animal vocalizes in direct response to application of a head holder or body restraint. Cattle, pigs, and sheep may respond by struggling. Further information on cattle restraint devices is in Ewbank et al. (1992) and Grandin (1992). Only flat or smooth rounded surfaces should come in contact with the animal. Animals will react or struggle if their skin is pinched by a restraining device. To determine the cause, watch closely and determine which part of the restraint apparatus moves when the animal reacts.

### *V-conveyor restrainers, center track (double rail), and band (monorail) conveyor restrainers*

If animals struggle or vocalize in a V-conveyor restrainer, it may be caused by the following problems: one conveyor side runs faster than the other, or the

angle of the two conveyors is too steep. If the angle is too steep, blood splash (petechial hemorrhages) may be increased in lambs (Thornton et al., 1979). When a V-restrainer is used for electrical stunning, one side running faster than the other may cause blood splash. There is a good diagram in U.S. Patent 2,185,949 (Regensburger, 1940).

For cattle and calves, a restrainer whereby the animals straddle a moving conveyor may be less stressful (Westervelt et al., 1976; Giger et al., 1977). Pigs restrained on a single moving conveyor were less stressed and had lower blood splash than pigs restrained in a V-conveyor or restrainer (Lambooij et al., 1992; Griot et al., 2000). Further information on conveyor restrainers for cattle and sheep is in Grandin (1988, 1991, 2003). Holding sheep or cattle in an upright position is the least stressful way to hold them (Westervelt et al., 1976; Dunn, 1990; Yardimci et al., 2013). To prevent cattle from struggling, vision-blocking panels should be installed as shown in Grandin (2003). On all types of conveyor restrainers, a false floor should be installed to prevent incoming animals from seeing the visual cliff effect (Grandin, 1991; Grandin, 2003). Sheep can see depth (Lemmon and Patterson, 1964). This may explain why they may refuse to enter a restrainer when they can see that it is raised up off the floor. Grandin (2001) reported that installation of a false floor in a cattle center track restrainer made it possible to reduce both electric prod use and vocalization. Cattle and sheep struggled when their bodies slipped when a restrainer was rotated. The best restrainers have adjustable squeeze sides to hold the animal's body. Conscious livestock should not be suspended by the legs or ankles (OIE, 2019a).

## Lameness Scoring

Lame animals of all species that have difficulty walking may be more difficult to handle in a low-stress manner (Grandin, 2015). Lameness scoring can be used to determine which producers or dealers have delivered high percentages of lame livestock. Edwards-Callaway et al. (2017) developed a simple, easy to use system for scoring animals when they unloaded. The scores are (1) normal, (2) lame but keeps up with the walking group, (3) lame and cannot keep up, and (4) almost a downer. A study by Davis-Unger et al. (2019) indicated that there are big differences in the percentage of lame feedlot cattle from different producers.

## Transport and Supply Chain Problems That May Have an Effect on Conditions at the Abattoir

Livestock that are moved through auctions may have more bruises (Strappini et al., 2009). Changing the way that livestock transporters are paid may also help reduce bruises. They should be paid based on the condition of animals after they arrive; they should not be paid based on the weight being transported. Bruises on feedlot cattle were reduced by half when feedlots had them subtracted from their payment (Grandin, 1981). Other factors that will increase bruises are overloaded trucks (Tarrant et al., 1988). The way that a truck is driven may also have an effect on bruises (Tarrant et al., 1988). Larger cattle may hit their backs on low ceilings (Lee et al., 2017). In pigs, overloading of trucks increased both nonambulatory pigs and losses (Ritter et al., 2006; Pilcher et al., 2011).

### *Old cull animals*

A major welfare issue is old cull dairy cows and other breeding stock that arrived at the abattoir in poor condition (Edwards-Callaway et al., 2019). Many of these animals should have been euthanized on the farm. A recent survey showed that 8% of old dairy cows had a full udder when they arrived at a slaughter facility. This is both a welfare and a meat quality issue due to possible contamination of the meat with milk (Harris et al., 2017). The OIE (2019a, 2019b) and many private industry standards have guidelines on fitness for transport.

### *Hernias in pigs*

Welfare Quality Network (2009) has excellent scoring tools that show large umbilical hernias. If a hernia is dragging on the floor, the pig is not fit for transport.

## Example of a Severe Welfare Problem That Had To Be Corrected at the Farm

When a meat company has control of the complete supply chain, it is often possible to make dramatic improvements. It is important to discuss on-farm factors because the author has observed that some severe welfare problems that have occurred in a slaughter plant were impossible to remedy at the plant.

The author consulted with a large, new pork plant that had excellent new lairage and handling facilities. When this abattoir first opened, 5 or 6 full-time employees were required to handle several hundred nonambulatory downed pigs. The handlers at this slaughter plant were doing an excellent job, and no electric prods were used. Even though handling was excellent, they still had many downed pigs. In this case, the solution to the problem was changing conditions on the farm. After the improvements, the number of people required to handle downers was reduced to 1 part-time employee. The following 3 changes were made on the farms.

- Producers were trained to walk their pens to get the pigs accustomed to people walking through them. They walked quietly through the finishing pens every day to train the pigs to quietly get up and move away Research has clearly shown that a pig's experience on the farm with handling will affect how it will react in the future (Abbott et al., 1997; Geverink et al., 1998; Lewis et al., 2008; Krebs and McGlone, 2009).
- They removed a genetic boar line from their breeding program that had structural leg conformation problems. This reduced lameness problems and improved mobility. On a previous visit to this client, 50% of the market pigs from this boar line were lame due to poor leg structure. Indiscriminate selection for carcass or reproduction traits may be linked to poor leg conformation. Breeding sows selected for good structural conformation of their legs have a longer productive life (Le et al., 2016).
- They reduced the dose of ractopamine. High doses may cause problems with downers or handling (Peterson et al., 2015; Ritter et al., 2017).

## How to Locate Sources of Problems

Implementing a comprehensive program of assessment of handling in the slaughter plant can help keep standards high (Grandin, 2010). When a problem is located, the first step is to determine whether it occurred before arrival at the slaughter plant or inside the abattoir. For example, there are differences in pig genetics and the tendency to have either PSE meat or a higher percentage of deads (Murray and Johnson, 1998). If bruises are elevated, the first step is to locate and correct problems that occurred inside the abattoir. If a particular supplier has elevated bruises, there will usually be a pattern of bruises that occurred on their livestock. When bruises are caused by conditions inside the plant, they will often occur on the same location on livestock from many different producers or transporters. Successful troubleshooting of either handling or meat quality problems will require both detective work and good record keeping. Records of bruises, deads, downers, lameness, and other conditions can be used to locate the sources of problems.

## Conclusions

The use of calm, low-stress methods to handle and move livestock results in both improved animal welfare and improved meat quality. Short-term stresses a few minutes before stunning, such as electric prods or jamming in the race, may increase PSE in pigs or tougher meat in beef. Management should implement simple change in both handling methods and equipment. When a problem is detected, the next step should be to determine whether the cause is inside or outside of the abattoir.

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