The religious slaughter of animals is an issue of contention in many parts of the world, although less so in the U.S. The U.S. experience with this topic might be of some interest. However, before beginning to focus on the religious slaughter of animals, it is important to frame the broader issues of slaughter within the U.S. legal system. As an outgrowth of consumer reaction to the book “The Jungle” written by Upton Sinclair (1906), the U.S. Congress passed various laws to create new approaches to food regulation. These have evolved with time, but at this time the responsibility for most traditional red meat (mammals) and birds used for food, and liquid eggs, is under the jurisdiction of the Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture. For most common food animals, FSIS inspection is mandated for interstate sales. For other animals (e.g., ostrich and camel), inspection is available on a fee-for-service basis but is not mandatory. Although a cabinet level department is very similar to a ministry in most other countries, these departments...
are much more stable and it takes an act of Congress, which is difficult to do, to change the organizational structures. The head of the FSIS reports directly to the Undersecretary of Agriculture for Food Safety. All other food products are under the jurisdiction of the Food and Drug Administration, which is buried deep in the Department of Health and Human Services.

Thus, the handling of meat (meaning in this chapter the species that are under FSIS) in the U.S. is subject to very intensive inspection (continuous for slaughter, at least once a day for processing) and a great deal more direct control (e.g., label approval) than all other food products. The cost of these inspections is borne by the government. An animal covered by FSIS regulations cannot be moved into the market place without having been inspected. (Some states have systems in place for state inspection—until very recently such slaughtered products could only be sold within the state. Under some recently developed procedures, such state meat can sometimes be sold outside of the state, i.e., by basically proving that the plant is equivalent to a directly inspected federal plant.) The other exception to federal inspection is custom slaughter—one can slaughter an animal (or have it slaughtered for you) that one owns following more limited state rules (with each state having its own rules), but then one cannot sell any of the meat or by-products. You can give them away, so that the Muslim tradition of keeping one-third for one’s immediate family, one-third for the extended family/community, and one-third for zakat (charity) is possible.

Because of the continuous involvement of FSIS, the practical issues that arise with the religious slaughter of animals and how that process interacts with the government inspectors had to be negotiated. Because all labels are approved by USDA, this also means that at some level they are approving the religious slaughter of animals by putting the mandatory USDA “wholesomeness” seal on products. So FSIS does at least try as part of its label review to determine that the claim of kosher or halal has some broad validity, namely, that there is a reasonable basis for such a claim.

In the late 1950s, the U.S. government, including Congress, began to debate some of the issues that need to be addressed to assure the humane slaughter of animals. This included the religious slaughter of animals.

In 1958, a Humane Slaughter Act was debated and eventually passed and became law. It has two portions that are directly of interest to the religious slaughter of animals.

The first section is a “finding” of the U.S. government that the following methods of slaughter are humane:

7 U.S.C.A. § 1902. HUMANE METHODS

No method of slaughtering or handling in connection with slaughtering shall be deemed to comply with the public policy of the United States unless it is humane. Either of the following two methods of slaughtering and handling are hereby found to be humane:

a. in the case of cattle, calves, horses, mules, sheep, swine, and other livestock, all animals [not poultry] are rendered insensible to pain (unconscious) by a single blow or gunshot or an electrical, chemical or other means that is rapid and effective, before being shackled, hoisted, thrown, cast, or cut; or
b. by slaughtering *in accordance with* the ritual requirements of the Jewish faith or any other religious faith that prescribes a method of slaughter whereby the animal suffers loss of consciousness by anemia of the brain caused by the simultaneous and instantaneous severance of the carotid arteries with a sharp instrument and handling in connection with such slaughtering.


The second section of the bill provides for an “exemption” for the religious slaughter of animals. The exemption covers both the pre-slaughter handling of the animal and the actual slaughter.

7 U.S.C.A. § 1906. EXEMPTION OF RITUAL SLAUGHTER

Nothing in this chapter shall be construed to prohibit, abridge, or in any way hinder the religious freedom of any person or group. Notwithstanding any other provision of this chapter, in order to protect freedom of religion, ritual slaughter and the handling or other preparation of livestock for ritual slaughter are exempted from the terms of this chapter. For the purposes of this section the term "ritual slaughter" means slaughter in accordance with section 1902(b) of this title.


There are two important issues to discuss. The first is that the two sections seem to contradict each other. Is the religious slaughter of animals humane or is it exempt from such considerations? Apparently, the history of the legislation, which was supervised by Senator Hubert Humphrey from Minnesota, who later was a vice-president of the U.S. under President Jimmy Carter, was responsible for the bill. A historian, Roger Horowitz, in a book that was recently published (*Kosher USA*) has reviewed the history of this bill and shows that this ambiguity was intentional, namely, that to get acceptance by various stakeholders, these conflicting statements were necessary. Most people when they discuss this bill in terms of the religious slaughter of animals tend to focus on the one of these two approaches that suits their rhetorical need!

The other issue is that of the exemption for pre-slaughter handling of the animal for religious slaughter. This has over time become better defined and essentially creates a “bubble” around the immediate pre-slaughter handling of animals. So the bulk of the handling of the animal is covered by any requirements imposed on all slaughterhouses. But this still exempts the immediate handling prior to the religious slaughter of animals. It is the authors’ contention that this exemption with 20-20 hindsight is unfortunate. Progress in improving animal handling for religious slaughter would probably be much further along without this exemption. And as long as handling does not interfere with the religious slaughter of the animal, there is no reason to exempt it from meeting good animal handling practices.

This might also be an appropriate point to discuss the issue of the wording used when describing the religious slaughter of animals. Having done polling of students in classes on animal welfare, and on kosher and halal food regulations, it is clear that
the “religious slaughter of animals” is much more acceptable to the (American) students than the term “ritual slaughter of animals,” which is often used when a negative reaction is desired. Wording does matter. For more on this issue with respect to other aspects of discussing the slaughter of animals, please see the article by Regenstein (2012) entitled “The Politics of Religious Slaughter—How Science Can Be Misused” (Reciprocal Meat Conference Proceedings).

FSIS, as previously mentioned, reviews the labels of all products under its jurisdiction. Thus, for the religious slaughter of animals, the claim of “halal” on a finished product will fall into two categories. If a generic claim of halal is made, FSIS will permit it without label approval. However, if a claim of halal is made with specific reference to a certifying agency, then FSIS will require that the food company provide documentation to substantiate such claims. The FSIS given U.S. tradition does not try to judge the “quality” of the certification provided. But consumers need to recognize that the generic “halal” is not authenticated while a specific agency certification is at least validated by FSIS.

In recent years, animal welfare has become a more important consideration in the animal foods industry. The issues of animal slaughter have been addressed for many years by the American Meat Institute, which recently became the North American Meat Institute (NAMI). Working with the pre-eminent animal welfare scientist in the U.S., Dr. Temple Grandin, professor of Animal Science at Colorado State University and owner of Grandin Livestock Handling, NAMI has developed a set of animal welfare guidelines. Based on Dr. Grandin’s work, the key to a good set of guidelines is to have measurable parameters that are routinely monitored.

It should be noted that Dr. Grandin is possibly the highest functioning autistic person in the U.S. She has used her autism to see the world the way animals see the world. Her website (www.grandin.com) includes a section on the religious slaughter of animals and is highly recommended.

The NAMI guidelines include a section on the religious slaughter of animals. These are found in the following section (courtesy of the North American Meat Association with their permission).

SECTION 5: RELIGIOUS SLAUGHTER (KOSHER AND HALAL)

Cattle, calves, sheep or other animals that are ritually slaughtered without prior stunning should be restrained in a comfortable upright position. For both humane and safety reasons, plants should install modern upright restraining equipment whenever possible. Shackling and hoisting, shackling and dragging, trip floor boxes and leg-clamping boxes should never be used. In a very limited number of glatt kosher plants in the United States and more commonly in South America and Europe, restrainers that position animals on their backs are used. For information about these systems and evaluating animal welfare, refer to www.grandin.com (Ritual Slaughter Section). The throat cut should be made immediately after the head is restrained (within 10 seconds). Small animals such as sheep and goats can be held manually by a person during ritual slaughter. Plants that conduct ritual slaughter should use the same scoring procedures except for stunning scoring, which should be omitted in plants that conduct ritual slaughter without stunning.
Cattle vocalization percentages should be five percent or less of the cattle in the crowd pen, lead up chute and restraint device. A slightly higher vocalization percentage is acceptable because the animal must be held longer in the restraint device compared to conventional slaughter. A five percent or less total vocalization score can be reasonably achieved. Scoring criteria for electric prod use and slipping on the floor should be the same as for conventional slaughter.

Animals must be completely insensible before any other slaughter procedure is performed (shackling, hoisting, cutting, etc.). If the animal does not become insensible within 60 seconds, it should be stunned with a captive bolt gun or other apparatus and designated as non-Kosher or non-Halal.

**Upright Pen**—This device consists of a narrow stall with an opening in the front for the animal’s head. After the animal enters the box, it is nudged forward with a pusher gate and a belly lift comes up under the brisket if needed.

The head is restrained by a chin lift that holds it still for the throat cut.

Vertical travel of the belly lift should be restricted to 28 inches (71.1 cm) so that it does not lift the animal off the floor. The rear pusher gate should be equipped with either a separate pressure regulator or special pilot operated check valves to allow the operator to control the amount of pressure exerted on the animal. Pilot operated check valves enable the operator to stop the air cylinders that control the apparatus at mid-stroke positions.

The pen should be operated from the rear toward the front [author insert: i.e., the back pusher should be set before the belly lift and both before the head holder].

Head restraint is the last step. The operator should avoid sudden jerking of the controls. Many cattle will stand still if the box is slowly closed up around them and less pressure will be required to hold them.

Ritual slaughter should be performed immediately after the head is restrained (within 10 seconds of restraint).

An ASPCA pen can be easily installed in one weekend with minimum disruption of plant operations. It has a maximum capacity of 100 cattle per hour and it works best at 75 head per hour or less. A small version of this pen could be easily built for calf plants.

**Conveyor Restrainer Systems**—Either V restrainer or center track restrainer systems can be used for holding cattle, sheep or calves in an upright position during Shehita or Halal slaughter. The restrainer is stopped for each animal and a head holder positions the head for the ritual slaughter officials. For cattle, a head holder similar to the front of the ASPCA pen can be used on the center track conveyor restrainer. A bi-parting chin lift is attached to two horizontal sliding doors.

**Small Restrainer Systems**—For small locker plants that ritually slaughter a few calves or sheep per week, an inexpensive rack constructed from pipe can be used to hold the animal in a manner similar to the center track restrainer. Animals must be allowed to bleed out and become completely insensible before any other slaughter procedure is performed (shackling, hoisting, cutting, etc.). (See Figures 7.1 through 7.3 for details.)

Before continuing, it is important to note that the above material is part of a larger document. For the purpose of this chapter, the information as presented is sufficient,
but before actually using the guidelines directly in a slaughter plant, it is strongly urged that the entire guidelines be looked at on their website.

With the increased interest in animal welfare, these guidelines are being required by more and more end users, both in the fast food/restaurant industry and by supermarkets and other retail outlets. This has meant that the larger slaughterhouses are meeting these guidelines. The generally smaller religious slaughterhouses have a choice: To only sell to the religious community or to meet these guidelines so meat can be sold beyond into some of those markets requiring such standards. That is a choice each plant has to make, but the author would strongly encourage all slaughterhouses to meet

FIGURE 7.1  Restrainer system for religious slaughter of calves and sheep—upright pen.

FIGURE 7.2  Upright Pen for religious slaughter of cattle.
these standards, especially with plants doing religious slaughter of animals. Given the controversies, why allow those who would attack religious slaughter to have sympathetic grounds by being able to document breakdowns in animal welfare!

In more recent years, FSIS has also begun to take animal welfare more seriously. So they now have animal welfare inspectors and they do have guidelines that they are enforcing requiring a higher level of animal welfare. So, it is incumbent on slaughterhouses in the U.S. including those doing the religious slaughter of animals to upgrade their activities. This is happening slowly, but is happening.

In practice, this attention to animal welfare has meant that larger animals are being slaughtered religiously in some sort of restraining pen. In the U.S. at this time, it is the authors’ understanding that all large animals such as cattle and bison are handled with some sort of restraint system. Small animals can also be handled by high speed upright handling systems such as those developed by Dr. Grandin. Many sheep facilities around the world are now using the “V restrainer” developed by Dr. Grandin. However, the use of shackle and hoisting, that is, the handling of a live sheep and goats by chaining one leg to hoist it off the ground is still being done in the U.S. for both kosher and halal. This is one area where acceptance of proper equipment and making the required investment would improve animal welfare and would demonstrate the commitment of the religious communities to combining the religious requirements with proper animal welfare.
One area that remains controversial in the Muslim community is the issue of pre-stunning of animals prior to the traditional cut across the neck. There is a great deal of literature discussing the various pre-slaughter stunning techniques that might be acceptable for Muslim use. The issue remains of how to be sure that all animals that are stunned are alive at the time of slaughter. In the U.S., both a traditional slaughter and pre-stunned slaughter are used for halal meat. It would be helpful if a system of labeling halal meat were developed to indicate whether meat had been pre-stunned or not so Muslim consumers could make an informed decision. Although there have been surveys in other countries, there are no surveys indicating the percentage of Muslim Americans who accept stunning or of the percentage of Muslim Americans who simply assume that the traditional method was being used for meat and poultry labeled as halal.

The authors are involved in various aspects of improving the religious slaughter of animals focusing currently on the use of a razor sharp knife of the appropriate length (twice the width of the neck and straight) without nicks. However, a detailed discussion of these issues of religious slaughter of animals is beyond the scope of this chapter, but has been covered in the previous chapter.

Another important effort to frame religious slaughter properly is the American Veterinary Medicine Association’s (AVMA) work on humane slaughter. The AVMA has been the leader in establishing criteria for euthanasia. Their euthanasia guidelines are generally considered to be the standard that is certainly widely used within the U.S., including most universities that are meeting the federal animal welfare requirements, mainly through the National Institutes of Health (an agency housed within the same organization as the FDA). But they have realized that the euthanasia document does not address two other critical animal welfare issues, namely, depopulation in the case of the need to kill many animals at one time and the issue of the humane slaughter of animals for food. The latter panel has been meeting and their report has been published after extensive reviews within many parts of the veterinary community. Dr. Temple Grandin and the senior author were the main authors of the section on the religious slaughter of animals. A copy of that section of the report is found below (with permission of the AVMA). Again, as with the NAMI guidelines, readers should not use these recommendations directly in a slaughter plant without consulting the entire document, which is now available on the AVMA web site (www.avma.org).

DESIGN OF FACILITIES AND SLAUGHTER PROCESS FOR RELIGIOUS SLAUGHTER

HANDLING PROCEDURES AT SLAUGHTER PLANTS FOR HOOFSTOCK

Steps 1 through 5
Refer to the chapter Design of Facilities and Slaughter Process for information on arrival at the plant, unloading, receiving, lairage, and handling. The procedures for these steps are the same regardless of whether the animals will be slaughtered via conventional or religious methods.
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Step 6—Restraint

There are various methods used to restrain and position the animal for religious slaughter. In the United States, there is an exemption from the HMSA (1958) for religious slaughter, and methods for restraining the animal for religious slaughter are outside the jurisdiction of USDA FSIS regulations, although Congress has also declared religious slaughter to be humane. The area covered by the handling exemption has been called the area of “intimate” restraint by the FSIS. When an animal is slaughtered in accordance with the ritual requirements of the Jewish faith or any other religious faith that prescribes a method of slaughter whereby the animal suffers loss of consciousness by anemia of the brain caused by the simultaneous and instantaneous severance of the carotid arteries with a sharp instrument, the HMSA specifically declares such slaughter and handling in connection with such slaughter to be humane. However, all procedures outside this area, which many meat inspectors call the “bubble,” are beyond the area of intimate restraint and are subject to FSIS oversight the same as conventional slaughter. Unloading animals from transport vehicles, lairage, driving the animals to the restraint point, and insuring that the animal is unconscious with no corneal reflex before invasive dressing procedures begin are under FSIS jurisdiction, the same as conventional slaughter.

Detection of Problems

From an animal welfare standpoint, there are three issues that occur during religious slaughter, which uses a neck cut to create unconsciousness. They are as follows: (1) stress, (2) pain or discomfort caused by how the animal is held and positioned for religious slaughter, and (3) the throat cut itself. Because the HMSA regulations exempt restraint of animals for religious slaughter from the regulations that apply to restraint for conventional slaughter, some small religious slaughter plants use stressful methods of restraint such as shackling and hoisting of live animals even though more welfare-friendly restraint equipment is available. Research has clearly shown that upright restraint is less stressful than shackling and hoisting for sheep and calves (Westervelt et al., 1976). In one study by Dunn (1990) restraining cattle on their backs for over a minute caused more vocalization and a greater increase in cortisol than upright restraint in a standing position for a shorter period of time. Another study by Verlarde (2014) showed that cattle vocalized less in an upright restraint compared to rotating boxes. The OIE also recommends that stressful methods of restraint, such as shackling and hoisting, shackling and dragging, and leg-clamping boxes should not be used, and suspension of live cattle, sheep, goats, or other mammals by their legs is not permitted in the United Kingdom, Canada, Western Europe, and many other countries. Fortunately most mid- to large-size religious slaughter plants in the United States have stopped this practice because of concerns for both animal welfare and worker safety. One study by Grandin (1988) found that conversion of a system that used shackling and hoisting to a conveyor restrainer reduced worker injuries.

Upright restraint is less stressful for both mammals and poultry, compared with being suspended upside down (Westervelt et al., 1976; Bedanova et al., 2007; Kannan et al., 1997). Sheep were less willing to move through a single-file chute after having been subjected to inverted restraint, compared with being put into a restraint device in an upright position (Hutson, 2014). In two different plants where cattle were
suspended by one back leg, the percentage of cattle that vocalized varied from 30% to 100% an increased percentages of cattle that vocalize (mooing or bellowing) during restraint are associated with increased cortisol levels (Dunn, 1990). In one study by Grandin (1998) 99% of the cattle vocalizations during handling and restraint were associated with an obvious aversive event such as the use of electric prods or excessive pressure from a restraint device. In cattle, vocalization scoring is routinely used to monitor handling and restraint stress (Grandin, 2013, 2010), and no more than 5% vocalization (3% for non-religious animal slaughter) is acceptable according to the North American Meat Institute standards (Grandin, 2013). The difference in the percentages for acceptability relates to the differences in handling between the two procedures. Vocalization scoring does not work for evaluating the handling and restraint stress in sheep because they usually do not vocalize in response to pain or stress. This may be due to an instinctual inhibition of vocalization in response to the presence of predators (Dwyer, 2004). Research is needed to evaluate vocalization as a method to evaluate stress in goats. The following methods of restraint are highly stressful for conscious mammals and should not be used: hoisting and suspension by one or more limbs, shackling by one or more limbs and dragging, trip floor boxes that are designed to make animals fall, and leg-clamping boxes. Even though suspension is stressful for conscious poultry, such as chickens and turkeys, it is used in a vast majority of all U.S. poultry plants for both conventional and religious slaughter; with attention to handling details and proper equipment, the stress can at least be minimized.

Corrective Action for Problems with Restraint

For the religious slaughter of cattle, restraint devices are available that hold the animal either in an upright position (Figure 7.4) or inverted onto their backs. Smaller

FIGURE 7.4 Recommended restraint of cattle for religious or ritual slaughter.
ruminants, such as sheep or goats, can be held in an upright position by people or placed in a simple restraint device (Westervelt et al., 1976). Large heavy animals, such as cattle or bison, must be held in a mechanical device that holds them in an upright position, holds them in a sideways position, or inverts them onto their backs. Vocalization scoring of cattle can be used both to detect serious welfare problems during restraint of cattle and to document improvements in either design or operation of restraint devices. In cattle, when restraint devices for religious slaughter are operated poorly or have design problems, such as excessive pressure applied to the animal, 25% to 32% of the cattle vocalize (Grandin, 1998; Bourquet et al., 2011). In one study by Grandin (2001) reducing pressure applied by a head-holding device reduced cattle vocalizations from 23% of the cattle to 0%. These problems can occur in both upright and rotating boxes. When the equipment is operated correctly, the percentage of cattle that vocalize will be under 5% (Grandin, 2010, 2012). Inversion for over 90 seconds in a poorly designed rotating box had a higher percentage of cattle vocalizing and higher cortisol levels compared with holding in an upright restraint box (Dunn, 1990).

Information on the correct operation and design of upright restraint devices for religious slaughter can be found in reports by Grandin 1992; 1994, Grandin and Regenstein (1994) and Giger et al (1977). Upright restraint in a comfortable upright position is preferable. When a device that inverts an animal is required by some religious leaders, it should have adjustable sides that support the animal and prevent its body from slipping, twisting, or falling during inversion. Inversion onto the back facilitates the downward cutting stroke. Upright or sideways (lying on the side) restraint may be less aversive than full inversion. Hutson (2014) found that full inversion was more aversive to sheep than being held in an upright position. Sheep can be easily trained to voluntarily enter a tilt table, which tilts them sideways (Grandin, 1989).

It is important to minimize the time that an animal is held firmly by a head restraint. Head restraint using a mechanized device that tightly holds the head is more aversive than body restraint (Grandin, 1992). Before the throat cut, cattle that were held firmly in a head restraint often struggle more than cattle held in a body restraint with no head restraint (Grandin, 1992). Resistance to the head restraint occurs after approximately 30 seconds; therefore, it is important to perform the throat cut before struggling or vocalization begins. When struggling is being evaluated from an animal welfare standpoint, only struggling that occurs before loss of posture should be assessed. When Velarde et al. (2014) evaluated struggling in different types of restraint devices, they did not differentiate between struggling before or after loss of consciousness. Struggling while the animal is conscious is a welfare concern, and struggling from convulsions after an animal loses posture and becomes unconscious has no effect on welfare. Restraint devices should be equipped with pressure-limiting devices to prevent excessive pressure from being applied, which then causes either struggling or vocalization (Grandin, 1992). The percentage of cattle vocalizing (mooing or bellowing) either while in a restraint device or while entering it should be 5% or less (Grandin, 2010, 2012). Restraint devices should not cause animals to struggle or vocalize. For poultry, stress during shackling can be reduced by subdued lighting. Wing flapping can be reduced by installing vertical pieces of conveyor belting with a smooth surface for the breasts of the shackled birds.
to rub on. A possible future method to reduce bird stress while in shackles is the incorporation of a moving horizontal conveyor that supports the bird’s body (Lines et al., 2011). A Dutch poultry plant recently installed a system where each shackled chicken has its body supported in a plastic holder. In both large and small plants, where possible chickens can be held by a person in an upright position for the throat cut and then placed immediately either in a bleeding cone or on the shackle.

**Step 7—Performing the Throat Cut**

There are three basic ways that religious slaughter is performed: (1) pre-slaughter stunning before the throat cut with either a captive bolt or electric stunning, (2) immediate post-cut stunning with a non-penetrating captive bolt, or (3) slaughter without stunning (traditional hand slaughter). Some religious authorities who supervise either kosher (Jewish) or halal (Muslim) religious slaughter will allow either pre-slaughter or immediate post-slaughter stunning (Nakyinsige et al., 2013). For halal slaughter, electric head-only stunning is used in many large cattle and sheep plants in New Zealand, Australia, and the United Kingdom. Head-only electric stunning is acceptable to many Muslim religious authorities because it is fully reversible and induces temporary unconsciousness (refer to the section Techniques—Physical Methods—Electric). If pre-slaughter stunning is done, there will be no animal welfare concerns about the throat cut in a conscious animal. Since most pre-slaughter stunning methods that are approved for religious slaughter produce a lighter reversible stun, greater attention will be required to the details of procedures to ensure that the animals or birds are and remain unconscious during the throat cut. An effective reversible precut stun in sheep can be easily achieved with 1.25–2 A at a frequency range of 50–400 Hz. According to Grandin (2012, 2015), when the stunner was applied to the head for 1.5 seconds at 300 Hz, it produced a clear tonic rigid phase followed by a clonic kicking phase representative of an epileptic seizure. This pattern is an indicator that it produced unconsciousness. A modified New Zealand head-to-body stunner with the rear body electrode removed worked well because the design of the handle facilitated positioning of the stunner on the sheep’s head. In poultry a very light reversible electric water-bath stun is done. The preceding stunning methods are acceptable to a number of halal certifiers. Some halal certifiers will accept non-penetrating captive bolt because the heart will continue to beat after stunning (Vimini et al., 1983). Some religious communities will accept immediate post-cut stunning, and others require slaughter without stunning (traditional hand slaughter). Stunning methods are covered in the Techniques chapter of these guidelines.

**Detection of Problems**

The greatest welfare concerns may occur during traditional religious hand slaughter. There are two main issues: (1) Does cutting the throat of a conscious animal cause pain? (2) What is the maximum appropriate time that is required for the animal to become unconscious after a properly done throat cut? The throat cut done during both kosher and halal slaughter simultaneously severs both carotid arteries and jugular veins and the trachea. For halal slaughter, a sharp knife is required. Kosher slaughter has more strict specifications for how the cut is performed and the design and sharpening of the knife (Levinger, 2000). A kosher slaughter knife is long
enough to span the full width of the neck (i.e., double the width of the neck) and is sharpened on a whetstone. Before and after each animal is cut, the knife is checked for nicks that could cause pain (Levinger, 2000). Any nick in the knife makes the animal non-kosher, so there is a strong incentive to keep the knife razor sharp and nick free.

**Painfulness of the Cut**

Researchers have reported that cutting the throat of 107- to 109-kg (236- to 240-lb) veal calves with a knife that was 24.5 cm long caused pain comparable to dehorning (Gibson et al., 2009a, 2009b). The knife may have been too short to fully span the throat, and it had been sharpened on a mechanical grinder. A grinder may create nicks on the blade and may not be comparable to a knife sharpened on a whetstone. Slaughter without stunning of cattle with a knife that is too short will result in violent struggling because the tip makes gouging cuts in the wound (Grandin, 1994). One of the rules of kosher slaughter is that the incision must remain open during the cut (Levinger, 2000; Epstein; 1948). When the wound is allowed to close back over the knife, cattle will violently struggle (Grandin, 1994). When an animal is restrained in a comfortable upright position, it becomes possible to observe how the animal reacts to the throat cut. When a kosher knife was used by a skilled slaughter man (shochet), there was little behavioral reaction in cattle during the cut (Grandin, 1994). In calves, there has been a similar observation (Bager et al., 1992). Grandin (1994) reports that people invading the animal’s flight zone by getting near to the animal’s face caused a bigger reaction. An ear tag punch has also caused a bigger reaction than a good kosher cut (Grandin, 1994). Most chickens slaughtered by shechita exhibited no physical response to the cut, and they lost the ability to stand and eye reflexes at 12–15 seconds (Barnett et al., 2007).

**Time to Lose Consciousness**

Unconsciousness, as defined in the General Introduction of these Guidelines, is the loss of individual awareness that occurs when the brain’s ability to integrate information is blocked or disrupted. Before invasive dressing begins, all signs of brain-stem function such as the corneal reflex must be abolished by bleeding. Sheep will lose consciousness as determined by their EEG more quickly than cattle because of differences in the anatomy of the blood vessels that supply the brain (Baldwin and Bell, 1963a). In cattle, when the carotid arteries are severed, the brain can still receive blood from the vertebral arteries (Baldwin and Bell, 1963b). After the cut, sheep will become unconscious and lose posture and no longer be able to stand within 2–14 seconds, while most cattle will lose consciousness and no longer be able to stand within 17–85 seconds (Blackmore et al., 1983, 1984; Nangeroni and Kennet, 1983; Newhook and Blackmore, 1982; Schulz et al., 1978; Daly et al., 1988; Gregory and Wotton, 1984). In these studies, time to onset of unconsciousness was measured by either EEG or loss of the ability to stand (LOP). Allowing the wound to close up after a transverse halal throat cut with a 20-cm-long knife may delay onset of unconsciousness. Electroencephalographic measurements on sheep indicated consciousness could last 60 seconds (Rodriguez et al., 2012). In a study by Lambooij et al., 2012) where a rotating box was used to invert veal calves onto their
backs, unconsciousness was measured by EEG. It occurred at an average of 80 seconds. In sheep, unconsciousness as measured by time to eye rotation was 15 seconds (Cranley, 2012).

There is a large amount of biological variability, and a few cattle, calves, or sheep have extended periods of sensibility (>4 minutes) (Gregory and Wotton, 1984, 2012). If the animals can stand and walk they are definitely conscious. In sheep the corneal reflexes, which are a brainstem reflex, may be present for up to 65 seconds after the cut (Cranley, 2012). In veal calves, corneal reflexes were still present at 135 ± 57 seconds after the throat cut (Lambooij et al., 2012). The methods section of Lambooij et al. (2012) did not describe the type of knife. However, that study was done in a slaughter plant that performed halal slaughter. Corneal reflexes can also occur in electrically stunned or CO₂-stunned animals where other indicators of return to consciousness, such as the righting reflex, rhythmic breathing, and eye tracking, are absent (Vogel et al., 2011). Corneal reflexes occur during a state of surgical anesthesia (Rumpl et al., 1982) or when visual potentials and SEPs are abolished (Anil and McKinstry, 1991). One of the best indicators for determining onset of unconsciousness is the loss of the ability to stand or walk (LOP). In cattle, a major cause of prolonged periods of consciousness after the throat cut is sealing off of the ends of the severed arteries (false aneurysms) (Gregory et al., 2008). This problem does not occur in sheep.

**Aspiration of Blood**

Another welfare concern is aspiration of blood into the trachea and lungs after the cut (Agbeniga and Webb, 2012). In one study by Gregory et al. (2009) when cattle were held in a well-designed upright restraint, 36% (for kosher) and 69% (for halal) aspirated blood. In 31% of these non-stunned cattle, blood had been aspirated into the bronchi. It is likely that in a rotating box where the animal is held on its back, aspiration of blood will be higher.

**Corrective Action for Problems**

To reduce painfulness of the act, a knife that is long enough to span the neck where the tip will remain outside the neck during the cut should be used. It is also essential that the knife be extremely sharp, and the use of a whetstone is recommended. A good method for testing a knife for sharpness is the paper test. To perform this test, a single sheet of standard letter-size (8.5 × 11-inch) printer paper is dangled in a vertical position by being held by a thumb and forefinger by one corner. A dry knife held in the other hand should be able to start cutting at the edge of the paper and slice it in half. This method can eliminate the worst dull knives, but it may not detect sharp knives with nicks.

It is also essential to not allow the wound to close back over the knife during the cut. To prevent sealing off of the arteries in cattle, the cut should be angled so it is close to the first cervical vertebra (C1) position (Gregory et al., 2012a) as long as such a cut is accepted by the religious authorities. This will also cut a sensory nerve, which may prevent the cattle from experiencing distressful sensations from aspirating blood (Gregory et al., 2012b). The cut should be located posterior to the larynx and angled toward the C1 position.
Before invasive dressing procedures such as skinning or leg removal are started, the corneal reflexes must be absent. Even though an animal showing only a corneal reflex is unconsciousness, to provide a good margin of safety, it should be absent before dressing procedures start. Absence of the corneal reflex and complete unconsciousness before dressing procedures are started are best practices for all slaughter plants that conduct both conventional slaughter and religious slaughter.

AUDITING RELIGIOUS SLAUGHTER TO IMPROVE ANIMAL WELFARE FOR BOTH KOSHER AND HALAL SLAUGHTER OF CATTLE, SHEEP, OR GOATS

The following audit methods are recommended to maintain an acceptable level of animal welfare when religious slaughter is performed by cutting of the neck.

1. Calm animals will lose sensibility quicker. Follow all procedures for handling that are in other parts of this document (Grandin, 1992, 1994).
2. Conduct collapse-time scoring. When the best methods are employed, 90% of the cattle will collapse and lose the ability to stand within 30 seconds. Researchers in Europe reported a similar result when they used a well-designed upright restraint device (Gregory et al., 2010). In a rotating box, collapse-time scoring is impossible because the animal is on its back. Alternative measures for determining onset of unconsciousness are time until eye rotation and the amount of time to abolish the presence of natural blinking such as seen with a live animal in the yards (lairage). Natural blinking must not be confused with the corneal reflex. To evaluate natural blinking (menace reflex), a hand is waved within 4 inches (10 cm) of the eye without touching it. A natural blink occurs if the eye does a full cycle of closing and then reopening. Omit scoring of time to unconsciousness if pre- or post-cut stunning is used.
3. The vocalization score should be 5% or less for cattle (Grandin, 2010, 2012). Score on a per-animal basis, as a silent animal or a vocalizer (mooing or bellowing). All cattle that vocalize inside the restraint device are scored. A bovine is also scored as a vocalizer if it vocalizes in direct response to being moved by a person, electric prod, or mechanical device into the restraint device. Do not use vocalization scoring for sheep. Standards for vocalization scoring of goats will need to be developed.
4. In all species, score restraint methods for the percentage of animals that actively struggle before LOP.
5. The percentage of animals (all species) that fall down in the chute (race) leading up to the restraint device or fall before the throat cut in the restraint device should be 1% with a goal of zero. This is the same as conventional slaughter. Restraint devices that are designed to make an animal fall are unacceptable and result in an automatic audit failure. Rotating boxes must fully support the body, and the animal’s body should not shift position or fall when the box is rotated.
6. Electric prods should be used judiciously and only in extreme circumstances when all other techniques have failed (Leary et al., 2016). Score prod use using the same criteria as conventional slaughter.

7. Perform the cut quickly, preferably within 10 seconds after the head is fully restrained. Omit this measure if pre-slaughter stunning is used.

8. Reduce the pressure applied by the head holders (but do not remove it), rear pusher gates, and other devices immediately after the cut to promote rapid bleed out.

9. Corneal reflexes, rhythmic breathing, and all other signs of return to sensibility must be absent before invasive dressing procedures such as skinning, leg removal, or dehorning are started. This is a requirement for all methods of slaughter both conventional and religious to be absolutely sure that the animal is completely insensible.

10. Do not use stressful methods of restraint for mammals, such as shackling and hoisting by suspension by one or more limbs, shackling and dragging by one or more limbs, trip floor boxes that are designed to make animals fall, leg-clamping boxes, or other similar devices.

11. If either pre- or post-cut stunning is used, score the same as conventional slaughter.

R3 Auditing Religious Slaughter to Improve Animal Welfare for both Kosher and Halal Slaughter of Chickens, Turkeys, and Other Poultry

1. If stunning is used, audit and monitor the percentage of birds that are effectively stunned using the same criteria as for conventional slaughter.

2. Score the performance of shacklers for faults such as one-legged shackling using the same criteria as for conventional slaughter.

3. There should be 0% uncut red skinned birds that emerge from the de-feathering machine. This is an indicator that a bird entered the scalding alive. This measure is the same as used for conventional slaughter.

4. Score the percentage of birds that wing flap after restraint. In a well-designed shackles line with a breast rub conveyor, the percentage of flapping birds should be very low.

THE IMPORTANCE OF MEASUREMENT

By routinely measuring the performance of religious slaughter procedures, the standards for such slaughter are kept high. Measuring collapse times for unconsciousness or other indicators such as time to eye roll-back or the absence of natural blinking will enable both plant personnel and religious slaughter personnel to improve their procedures.


b. Grandin T, College of Agricultural Sciences, Colorado State University, Ft Collins, Colo: Personal communication, 2015.

c. Voogd E, Department of Animal Sciences, College of Agricultural, Consumer and Environmental Sciences, Urbana, Ill: Personal communication, 2009.
REFERENCES


