

# Principles of Jewish and Islamic Slaughter with Respect to OIE (World Organization for Animal Health) Recommendations

Pozzi, P.S.,<sup>1\*</sup> Geraisy, W.,<sup>2</sup> Barakeh, S.<sup>3</sup> and Azaran, M.<sup>4</sup>

<sup>1</sup> Veterinary Services and Animal Health, Ministry of Agriculture and Rural Development, Israel.

<sup>2</sup> Chief Inspector, "BakarTnuva" Slaughter Plant, Beit Shean, Israel.

<sup>3</sup> Inspector, "Dabbach" Slaughter Plant, Dir El Assad, Israel.

<sup>4</sup> Director, "Moreshet Avot", Sho"b, Jerusalem, Israel.

\* **Corresponding Author:** Dr. P.S. Pozzi, P.O.B. 12, Beit Dagan 50250, Israel. Tel: (+972) 50-6243951, Fax: (+972) 3-9681795. Email: [pozzi@moag.gov.il](mailto:pozzi@moag.gov.il).

### ABSTRACT

Israel is member of OIE (Organization for Animal Health) which since May 2005 has adopted animal welfare standards, including the slaughter of animals. Finalities of these standards are to ensure the welfare of animals, destined to food production, during pre-slaughter and slaughter processes, until their death. In Israel, slaughter is practiced without prior stunning as required by shechita and halal slaughtering, due to the vast majority of the population requesting kosher and halal meat. In both Jewish (Halacha) and Islamic (Sharia) Laws, particular attention is given to avoid unnecessary pain to animals in general and, in particular, in the course of slaughtering. Jewish shechita and Islamic dbach/halal slaughtering, when applied in the correct manner result in comparable, or even better, than large scale slaughters with prior stunning with respect to the avoidance of unnecessary pain. Shechita and halal, due to their intrinsic nature and due to their routine controls on every step and for every individual animal, cannot be regarded as negligent or intentionally painful, distressing or inducing suffering to animals. Improvements may be possible with regards to restraining equipment, anatomical position of the cut, post-cut wound management and continuation of procedures on carcass.

---

**Keywords:** Shechita; Halal; OIE: Slaughter; Pain.

### INTRODUCTION

Cruelty to animals is resolutely forbidden in Jewish halacha. Tanaim (*teachers of the oral law*) (Eretz Israel, 45-195 common era, (CE)) and Amoraim (renowned Jewish scholars who "said" or "told over" the teachings of the Oral Torah) (Eretz Israel, Babylon, 225-500 CE) disagree whether prohibition of cruelty to animal is a Torah commandment or a Rabbinical mitzvah (commandment) (1). The Gaonim (the presidents of the two great Babylonian, Talmudic Academies of Sura and PumbeditaI) (Babylon, 6<sup>th</sup>-10<sup>th</sup> century CE) stated that the prohibition of cruelty to animal originates from the Torah when great grief is involved, however the

prohibition to cause even a small amount of grief should be considered as a Rabbinical commandment. The Shulchan Aruch (compendium of those areas of the halacha – Jewish religious law- composed by Rabbi Yosef Karo of Safed in the 1560's), states that prohibition of cruelty to animals is a Torah commandment (2). The disagreement between the Sages seems to be relative to the fact that a person should rescue an animal in any case of an unfortunate event, danger or suffering (Torah commandment) while a person should abstain from inducing any form of grief to animals (Rabbinical commandment) (3). The Rishonim (*first commentators*, prior to Shulchan Aruch) (11<sup>th</sup>-15<sup>th</sup> century, CE) explained that some of the commandments and laws were finalized to avoid pain

of animals, and among these identified the commandment to slaughter an animal precisely from the neck “and with a verified (smooth and sharp) knife, so that we will not induce too much harshness on the animal” (4).

Islamic law is also compassionate about animals, and animals are highly esteemed by Islam (5) and Islam sharia provides considerable support for conscientiously attending to animal welfare (5); to the wisdom of Prophet Muhamad is in fact attributed “*Whoever is kind to the creatures of God, is kind to himself.*”

The “Office International des Epizooties” – OIE was established in January 1924 with purpose of combating animal diseases. In May 2003 the Office became known as the “World Organization for Animal Health” but kept its historical acronym “OIE”. The OIE is the intergovernmental organization responsible for improving animal health and animal welfare worldwide. In 2013 it had a total of 178 member countries, among which Israel is a member (6).

Beginning 2001, animal welfare was identified as a priority in the OIE organization, and Member Countries mandated the organization to elaborate recommendations and guidelines covering animal welfare practices. Since May 2005, the World Assembly of OIE delegates have adopted 10 animal welfare standards, including, among others the slaughter of animals (7). These recommendations are intended to ensure the welfare of animals, destined to food production, during pre-slaughter and slaughter processes, until their death. These recommendations apply to both the slaughter in slaughterhouses and outside of them, and to all major species intended for human consumption.

The purpose of this article is to review and compare OIE recommendations with principles of Jewish halacha and Islamic sharia when performing slaughtering of animals destined to meat production for human consumption.

### **Jewish halacha and Islamic sharia requirements and the OIE recommendations**

Without consideration to transport of animals to the slaughter plants, the main issues linked with “animal welfare” at time of slaughter focus on: personnel (Table 1), restraint of the animal (Table 2), slaughtering or sticking techniques, unconsciousness evaluation, incision (the cut) management, verification of death of the animal and the

time when subsequent procedures for attending to the carcass can begin.

With the purpose of following a shared scheme, the comparison between Jewish, Islamic requirements and OIE recommendations will be carried out according to Chapter 7.5: Slaughter of Animals, of OIE - Terrestrial Animal Health Code – Version 7 – 07/07/2014 (7).

**Table 1:** Personnel

Jewish halacha	In principle anyone may practice shechita (8, 9), however only with the appropriate authorization ( <i>kabala le-shechita</i> ; acceptance to slaughter) by a Sage (10).
Islamic sharia	Operator competence is of great importance for carrying out satisfactory Halal slaughter (5).
OIE recommendations	Persons engaged in... slaughter and bleeding of animals... should be patient, considerate, competent and familiar with the recommendations outlined in the present chapter and their application within the national context. Competence may be gained through formal training and/or practical experience. This competence should be demonstrated through a current certificate from the Competent Authority or from an independent body accredited by the Competent Authority.

Is worth emphasizing that being a shochet (authorized slaughterer according to Jewish halacha) should be considered as a real profession requiring adequate training which is highly regulated with specific authorization and subject to controls. The Sages do not authorize slaughtering until the candidate shochet is knowledgeable concerning all details required; has performed a certain number of slaughters; is aware of how to maintain the shechita knife “sharp and smooth”; is able to feel, recognize and repair defects in the instrument and is able to recognize the effectiveness of his slaughtering method. The shochet himself, even when he has received the authorization to slaughter, is obliged to review the shechita rules, in order to avoid the risk of bad slaughtering (non-sharp knife; bad technique) which may induce unnecessary suffering to animals and the supplying of non-kosher meat to the population.

In Islamic sharia, slaughter is performed by sane (mentally competent) adult Muslim, Jew, or Christian as they are considered Ahl al-Kitab “People of the Book” as stated in Surat al-Ma’idah, Ayah 5:5.

**Table 2:** Restraint of the animal before slaughtering

Jewish halacha	“And (the shochet) shall know, that he must not hold the sheep alone on his knees, to slaughter, without the help of another person... And certainly not to slaughter cattle without assistance...” (11).
Islamic sharia	Animals should be securely restrained, particularly the head and the neck; restraining equipment should be comfortable for the animals; animals should not be shackled and hoisted before bleeding (5).
OIE recommendations	Provisions relevant to restraining animals for stunning or slaughter without stunning, to help maintain animal welfare. Methods of restraint causing avoidable suffering should not be used in conscious animals because they cause severe pain and stress.

Regarding restraint, the OIE recommendations in principle refers to two different situations:

- *Non-restraint:*

Includes animals stunned in groups (group gas stunning in pigs; electric stunning of single animals kept in groups: small ruminants, pigs); free roaming animals (shotgun bullet in ruminants). Some species are not of interest in Jewish and Islamic slaughtering for example pigs. Some methods are forbidden in both Jewish and Islamic law for example shotgun free bullet); other methods are forbidden in Jewish halacha such as electric stunning and slaughtering of unrestrained animals)

- *Individual restraint:*

- Upright restraint, with head restraint: manual; ropes or yokes; mechanical means (ruminants)

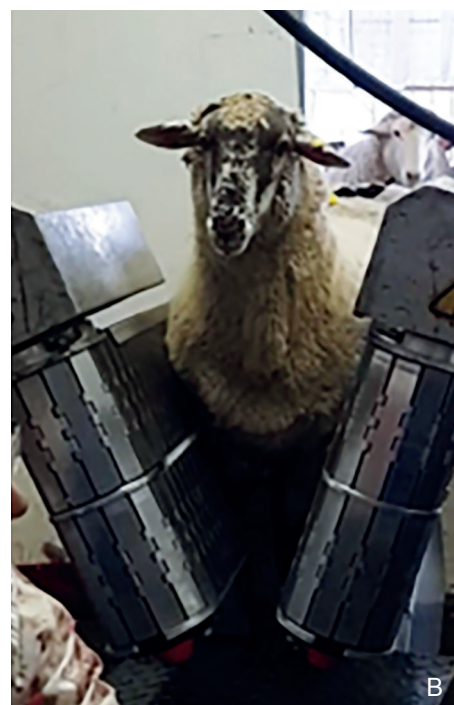
Shechita in upright position may be considered problematic: dealing with other issue, the Shulchan Aruch- Yoreh Deah (SAY”D): 6:4 refers (12) to the concept of slaughtering “down to up” thus underlining the possibility that the head of the animal may weigh on the knife, leading to pressure on the incision wound and in so doing nullifying the perfection of the shechita. From this, the reverse position (animal restrained on its back) (13) is the preferred method of restraint, unless the head of the animal is firmly restrained and the head cannot move down during the shechita (13) (Figure 1A and B). On this basis, as explained later, techniques have been developed in order to perform shechita in an upright position which has been accepted in Jewish communities, mainly in North America and, recently, in some European Countries.

- Upright restraint; with automatic conveyors (small ruminant) with the head restrained manually

As described above concerning the upright position; in the USA, shechita of small ruminants and calves in upright position, mechanically conveyed, is acceptable. The animal is restrained in a very humane manner, comfortably upright. Another person other than slaughterer holds the head of the calf and sheep (14).



A



B

**Figure 1:** A. Upright restraint of calves. B. Upright restraint of small ruminants (drawing from 14).



It is emphasized that, contrary to the USA, EU Regulation 1099/2009 (“Protection of animals at time of killing”), does not allow manual head restraint for shechita, halal even if small ruminants (sheep, goats, young calves) are mechanically conveyed in an upright position.

c. Upright restraint, with single leg restraint/in flexion and where the animal stands on 3 legs and the head is not restrained, as in the case of pigs: this species is not of interest as they are disallowed in Judaism and Islam.

d. Reverse restraint: mechanical; rotating box.

Starting 19<sup>th</sup> century new mechanical restraint systems were introduced being more secure and safe for slaughter-plant operators and with the ability to speed up operations (Figure 2). Reverse restraint with the support of mechanical/rotating box has a long and controversial history. It was developed in UK for local shechita in 1908 under public pressure for the abolition of rope-restraint. The technique was approved by RSPCA (Royal Society for the Prevention of Cruelty in Animals) in 1927 and approved by UK Shechita Board in 1929. In 1930 it was approved by the UK Chief Rabbi and introduced in UK slaughter-plants in 1933, becoming compulsory for shechita in 1950 (15). In 1990

the method was phased out and eliminated and eventually outlawed by the end 2013 in favor of the USA upright model.

Animal welfare is a continuing evolutionary concept, for which something innovative at end of 19<sup>th</sup> century or in the 1930s, already after WWII required new reflections and changes, and this statement is valid to this day.

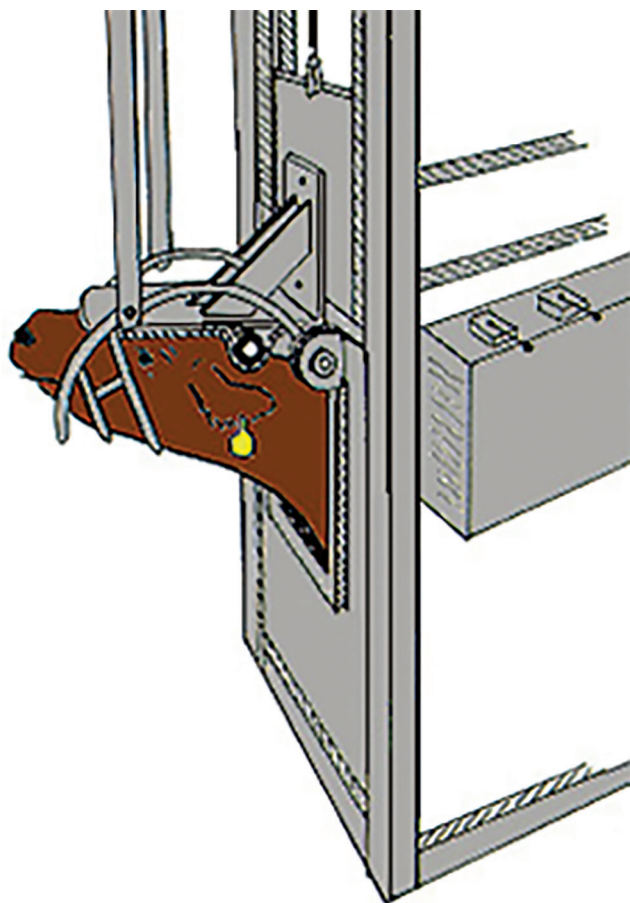
Starting the 1950's in the USA, on the initiative of Rabbi J. Soloveitchick, the American Orthodox Union (OU) started using the ASPCA (American Society for the Prevention of Animal Cruelty) pen, with its modifications, specifically for shechita, and OU progressively switched from shechita in reverse restraint to shechita in upright restraint.

Founded in 1866 by Henry Bergh, ASPCA was the first organization having as mission “to provide effective means for the prevention of cruelty to animals throughout the United States.” OU is managed by Rabbi M. Genack, past student of Rabbi J. Soloveitchick; considered ideologically close to Rabbi M.S. Shapiro and Rabbi S. Berembaum. The OU supervises the kasherut of some 8,000 plants in more than 80 countries.

Gradual adoption of shechita in upright position in the USA is part of the wider context in the search of a shared point of view between animal welfare concerns – including stress and panic reduction – and keeping of halachic principles. In East European countries, it wasn't uncommon to



**Figure 2:** One of the first rotating pens, the “Weinberg” pen, presented in Holland in 1928. Mr. H. Weinberg appears in the picture, on the left, with black overcoat (16).



**Figure 3:** ASPCA pen modified with chin-lift to accomplish with shechita in upright position (drawing from reference 18).

use shechita in the reverse position and attempts to introduce this kind of slaughter in the USA had negative consequences on the common perception of the shechita. The OU, under Rabbi M. Genack's leadership, strongly supported shechita in the upright position, in which the chin of the animal is held in order to avoid the disqualification of shechita due to "drassa" (halachic definition for hacking or pressing or any undue pressure). This was supported by projects of T. Grandin for the ASPCA together with Rabbi J. Soloveitchick and Rabbi M. Feistein (17).

In upright shechita the restraint of head and neck through the chin lift avoids the neck "falling" on the knife during the cut, which thing could induce the shochet to "force" the cut, or could even arrest the cut itself, which nullifies the shechita but also induces unnecessary pain to the animal due to prolonged or forced action (Figure 3).

*"The OU's preferred method of shechita, from a halachic*

*perspective, is upright shechita. Indeed, the OU will only grant supervision to shechita on reverse position if steps are taken by the company seeking the supervision to ensure the comfort of the animal"* (17). In the EU the use of the rotating pen is forbidden in Austria and the UK. In 2012 EU Commission called for a study (SANCO/2012/10357) to be performed in countries in which shechita is practiced, with the purpose of comparing shechita feasibility with restraint equipment in an upright/standing position with respect to reverse/back position. Results have been recently published, however limited to a small number of animals and abattoirs: i.e. 215 animals in total (31 cattle, 114 sheep and 70 broilers) in 3 abattoirs (one slaughtering cattle, one sheep; one poultry plant) were included in the study (19). However, in this study, when relating to the struggling of cattle judged according to the restraint position (upright, in modified Cincinnati-ASPCA pen), struggling of sheep, time to unconsciousness, the results from SANCO study differed to those data on shechita performed in the USA and Canada, observed by T. Grandin, in different USA slaughterhouses and involving some thousands of animals (18, 20).

#### e. Manual body restraint:

In contrast to shechita of small birds like chickens, during livestock slaughtering, the shochet is not allowed to restrain the animal by himself. Casting may be acceptable if the head is well restrained. This is commonly practiced on sheep and goats. During the shechita of large animals restraint is mandatory (11) and in the past, before restraining devices were realized, restraint was obtained by reversing the animal on its back, like any other non-kosher slaughter (Figure 4).



**Figure 4:** Restraining during shechita in Holland in the XVIII century (21).

f. suspension and/or inversion for poultry: shackling by legs on an automatic rack with or without stunning):

This is forbidden by Jewish halacha however it may be accepted by Islamic sharia (for example, commonly used in slaughter-plants in several Islamic countries) (22, 23).

### Stunning methods and derogations of stunning obligation

Taking into account that both in Jewish and Islamic law restraint is compulsory, this section refers only to stunning methods (OIE recommendations) applicable in the course of restraint (Table 3).

**Table 3:** Comparison of the laws of halacha, sharia and the OIE recommendation

Jewish halacha	Stunning is not permitted. Death of the animal must be the consequence of the direct act of the shochet (24) and performed on a healthy and “able to stand” animal (25), which is in opposition to stunning. Captive bolt stunning induces perforation of the meninges (and then, brain), thus rendering the animal unacceptable for consumption (26).
Islamic sharia	Some streams/communities conditionally allow electric stunning only (23, 27) if the animal is not dead.
OIE recommendations	Slaughter without stunning is not prohibited. Focus is on restraint methods when slaughtering without stunning.

Death resulting from other than a direct act of the shochet and other than in the accepted method, renders the animal unacceptable for consumption. Non-penetrating stunning, even electric, has not been proven to induce irreversible damage (mainly haemorrhages) of the Central Nervous System (CNS), thus rendering the animal unsuitable for consumption.

The method of stunning put the Muslims, too, in a contentious state compared to their traditional method of slaughtering, as when stunning is used, it should not lead to death of the animal before it is slaughtered. Apparently the approach is wider and different than in Jewish halacha. While we refer to Nakyinsige (23) and Zikrulla (27) for a complete discussion, we summarize the main issues, discussed in different Islamic Conferences and in different countries (23, 27):

- Procedures, electrical current, must be supervised by accredited Muslim personnel; head-to-body electric stunning is not halal compliant (23).

- Penetrative stunning: not permitted.
- Non-penetrative stunning: may be permitted on condition that the skull and bones are not cracked and death is caused by the slaughterer only.
- Electro-narcosis may be tolerated, including water-bath for poultry: animals should not die before the actual slaughtering; the animal should be able to recover within twenty seconds after been stunned; the animal should not suffer any pain.
- Carbon dioxide in the slaughtering procedures is permitted with the condition that it does not kill the animal or induce suffering.

On the other hand, some streams and/or in some countries, local Islamic Communities do not accept any form of stunning (27):

- Stunning or electro-narcosis of any form is of no benefit to either humans or animals; UK, 1986 (27).
- It is unlawful to eat meat coming from poultry and cattle stunned prior the actual slaughtering; EU Fatwa Council, 1991 (27).
- Stunning is not allowed as an Islamic method of slaughtering as it causes harm to the animal as well restricts spilling of the blood from the animal; UK, 2005 (27).
- Electric shock is unlawful; Yemen, 2006 (27).
- If the (*electrically stunned*) animal was definitely alive at the time of slaughter and was slaughtered correctly, it would be considered halal. However... it is appropriate to avoid such meat as far as possible, because staying away from doubtful things is part of the faith; Pakistan, 2005 (27).

### Slaughtering techniques/sticking

We should consider four different issues:

1. Adequacy of the instrument (knife) for slaughtering (Table 4)
2. Performing the cut (Tables 5 and 6)
3. Definition of slaughtering
4. Point of cut

**Table 4:** Adequacy of the instrument for slaughtering (knife)

Jewish halacha	Knife must be long at least twice the width of the neck of the animal to be slaughtered (28). The knife must be “ <i>sharp and smooth</i> ” (29); it must be rechecked after every shechita and before the next
----------------	---



Jewish halacha (continue)	one (30) <i>“and if he did not check, he will not slaughter”</i> (30). The point of the knife is, traditionally, square (see figure below) in order to avoid making incisions with it or using it for sticking. The knife must be wide enough not to be closed over by the incised tissues.
Islamic sharia	<i>“When you slaughter (an animal), slaughter it with perfection, you should sharpen your knife and you should give relief to the animal”</i> (31). The knife must be without blemishes or damage (5, 23); recommended length should be twice the width of the neck (23).
OIE recommendations	A <i>very sharp</i> blade or knife of <i>sufficient length</i> so that the point of the knife remains outside the incision during the cut; the <i>point</i> of the knife should not be used to make the incision; the incision should <i>not close over</i> the knife during the throat cut.



**Figure 5:** Poultry and small ruminant knives.

Shechita's knife is proportional to animal size (at least *“twice the width of the neck”*), which means about 45–48 cm for a veal calf and 55–60 cm for adult cattle.

#### *Performing the cut:*

According to Jewish law, the shochet should slaughter in the smoothest way, avoiding the imperfection /inaccuracies (illustrated and explained below) (14, *modified*), which nullify the shechita itself (Table 5). When explaining shechita laws, Sefer HaChinuch (4) clearly relates to the obligation of avoiding unnecessary pain to animals during slaughter. The restraint of the animal is fundamental because it prepares and presents the animal to the slaughter in the correct way.

#### ***Definition of slaughtering***

According to Jewish halacha, an animal – as such – is considered forbidden to eat, and only the shechita (slaughtering

according to Jewish halacha) transforms it into that suitable for consumption. Imperatives of shechita are derived from a mitzvà (commandment) which is found in the book of Deuteronomy, 12:21.

*«...you may slaughter animals from the herds and flocks the Lord has given you, as I have commanded you, and in your own towns you may eat as much of them as you want».* From the written text it is not possible to derive a particular methodology of slaughtering, but this is derived by the Oral Law, which is detailed and regulated both regarding the technique of slaughtering and the eligibility of the shochet to practice it.

**Table 5:** Comparison of the laws of halacha, sharia and the OIE recommendation for performing the cut for slaughter

Jewish halacha	<i>“on the esophagus and on the trachea. And in birds, on the veins too”</i> (32). The strict halacha requests to sever the esophagus and trachea in mammals and blood vessels also in birds. Already in the 10 <sup>th</sup> century CE, it was established that (33) <i>“a beast needs the cut of the strings”</i> (large blood vessels), and later again, too (34), and this is the common practice of shechita.
Islamic sharia	Stunning (if used), severing of trachea, esophagus and both the Carotid arteries and Jugular veins (23). <i>Prohibited to you are dead animals, blood, the flesh of swine, and that which has been dedicated to other than Allah, and (those animals) killed by strangling or by a violent blow or by a head-long fall or by the goring of horns, and those from which a wild animal has eaten, except what you (are able to) slaughter (before its death)</i> (35).
OIE recommendations	All animals should be bled out by incising both carotid arteries, and the vessels from which they arise (e.g. chest stick).

The need for severing the large blood vessels in the neck during shechita derives from the repeated severe prohibition in the Torah of consuming blood (36) and therefore the need of purging the meat from its blood. The topographical proximity between the halachic location of shechita cut, the halachic need of severing both (or most of) oesophagus and trachea, automatically includes the cut of most or all the large blood vessels (the two Carotid arteries; the external and the internal Jugular veins) in the neck, therefore inducing a massive and rapid blood loss.

**Table 6:** The laws of halacha for performing the cut for slaughter

Definition of inaccuracy	הלכות שהיטה	Translation and explanation (14, modified)	הגדרה הלכתית	מקור – source
delay	שהייה	Hesitation, during the incision, for even a moment.	התחיל לשחוט והגביה את הסכין לפני שיגמור. השוחט בהמה בסכין שאינו חד ונתעכב כשיעור שהייה בשחיטה...	שולחן ערוך יורה דעה – כ"ג: ב שולחן ערוך יורה דעה – כ"ג: ג
pressing	דרסה	Hacking or pressing instead of sliding with forward and backward movements.	הניח את הסכין על הצוואר ודחק וחתך למטה כחותך צנון או קשות. ...שכל שאין שיעור הוזה אי אפשר לשחוט בלא דרסה...	שולחן ערוך יורה דעה – כ"ד: א (כ"ד: ב – סעיף מתייחס לאורך לא מספיק של הסכין כגורם לדרסה)
digging	חלדה	Knife stabbed into the neck or buried by fur, hide, or feathers in the case of a bird. The knife must be visible along all the shechita.	שהכניס את הסכין... החליד את הסכין תחת העור או תחת צמר מסובך בצוואר הבהמה או תחת מטלית הקשור בצווארה...	שולחן ערוך יורה דעה – כ"ד: ז – כ"ד: ח
slipping	הגרמה	Slaughtering above the large ring in the windpipe or below upper lobe of the lung when it is inflated.	השוחט בקנה למעלה (או למטה) במקום שאינו ראוי לשחיטה. התחיל לשחוט והטה את הסכין חוץ למקום השחיטה.	שולחן ערוך יורה דעה – כ"ד: יב
tearing	עקור	Tearing the esophagus or the trachea during the shechita. It may happen if there is a nick in the knife. Tearing can occur in heavy birds if not correctly restrained.	שנעקרים (נקרעים) קנה או וושט בזמן השחיטה. השוחט תרנגול צריך לזהר שידחוק רגלו בקרקע או יגביהנו שלא ינעוץ רגלו בקרקע כדי שלא יעקור הסימנים.	שולחן ערוך יורה דעה – כ"ד: טו – כ"ד: כ

*Point of cut* (here only ruminants are considered, without extension to birds):

**Table 7:** Comparison of the laws of halacha, sharia and the OIE recommendation for the location of the cut

Jewish halacha	The place for the shechita is in the neck... below the slope of the thyroid... to the upper extremity of the ( <i>right</i> ) pulmonary lobe... (37) and in principle one will slaughter down of the large ring (cricoid cartilage (37)).
Islamic sharia	Cutting of the throat or slitting the hollow of the throat, which eventually cause its death. Thus, the best way is too severe the trachea ( <i>bulqum</i> ), esophagus ( <i>mari'i</i> ), and both jugular veins ( <i>wajadain</i> ) to hasten the bleeding and death of the animals. However the four schools of thoughts ( <i>Shafi, Maliki, Hambali, Hanafi</i> ) slightly differ in their opinions (27).
OIE recommendations	Bleeding out by severance of blood vessels in the neck without stunning.

The halacha location for a kosher cut is relatively wide, starting few centimeters down the cricoid cartilage, down to the basis of the neck, immediately before the first rib. But the SAY”D already referred to an ancient tradition

(37) by which the cut is performed “*in correspondence of the folded ear of the beast and of the animal*” – so far in the *upper third* of the neck.

Sharia scholars, despite differences regarding the method of slaughter, all agree that the site of slaughter under normal circumstances should be the upper part of the chest and throat (5, 23, 27). The spinal cord should not be cut and the head not severed completely (5, 27). Slaughter must be done in such a way that the animal’s life departs quickly and animal will not be left to suffer; bleeding must be spontaneous and massive. Slaughtering must be done once only; during slaughtering the animal must not be lifted up; multiple acts of slaughter on one animal are prohibited. A least two of the four blood vessels must be severed in order for the animal to become permissible for consumption (27).

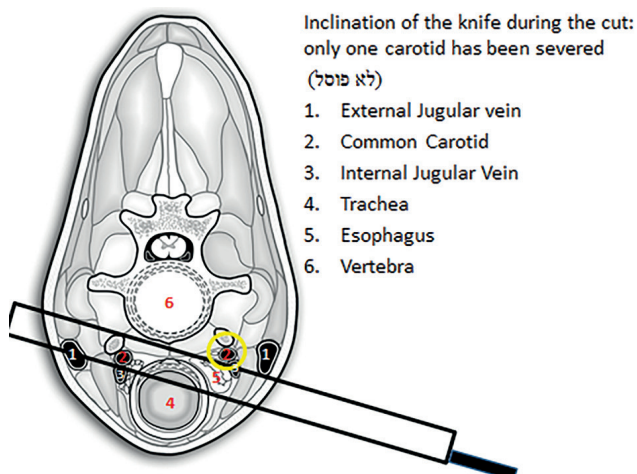
Referring to slaughter *without prior stunning* (shechita and halal slaughtering) the main issues are represented by slow blood loss and blood inspiration in the respiratory tract. Slow blood loss prolongs the time to unconsciousness, while blood inspiration induces pain due to suffocation.

**Slow blood loss** is the consequence of two different events:



## 1. Failure to cut both carotid arteries

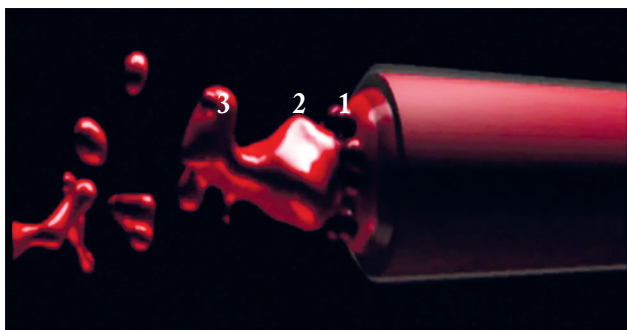
In a 2008 study, it was determined that the prevalence of failure to cut a carotid artery was 6% during shechita slaughter and 1% during halal slaughter (38). Failure is mainly due to the inclination of the knife during the cut (Figure 6). Where the blood loss is delayed the animal is not rendered immediately unconscious and therefore remains sensitive to pain (18) in the case of incorrect wound management (18) or too rapid initiation of processing the carcass.



**Figure 6:** Cross section of a neck of a calf: schematic representation of the failure to cut a carotid artery (#2) due to knife inclination (“Hullin Illuminated”, 2003, 136; modified; courtesy of author, Rabbi Y.D. Lach and Feldheim Publisher, Jerusalem, Israel).

## 2. Occurrence of a false aneurysm

When a severed artery rim retracts within its connective tissue sheath and the artery rim becomes blocked or sealed (23, 38), as below (Figure 7).



**Figure 7:** False aneurysm development: 1. Elastic layer of the artery retracts and shrinks; 2. Clots precipitate on the severed rim; 3. Blood flow reduces and slows down; 4. Artery is occluded; blood flow arrested (picture: courtesy Dr. W.Geraisy). (drawing: courtesy OIE).

It has been noted that insurgence of false aneurysm is higher when:

- The cut is performed in a low position in the neck (corresponding to 3<sup>rd</sup>-4<sup>th</sup> cervical vertebra (CV)) (38), (*data relating to halal slaughter*) compared to cutting at the 1<sup>st</sup> CV (39). Studies in the USA (39) revealed false aneurysms in 1% of arteries of cattle with shechita at 1<sup>st</sup> CV level; but up to 30% when shechita is performed in a lower position in the neck (3<sup>rd</sup> CV).
- The cut is “slow” (*probably due to imperfect sharpness of the knife, or hesitation by the shochet*). A possible explanation is that a slow knife stroke may be more likely to stretch the (*elastic layers of*) arteries and induce (*retraction, shrinking and*) occlusion (18).

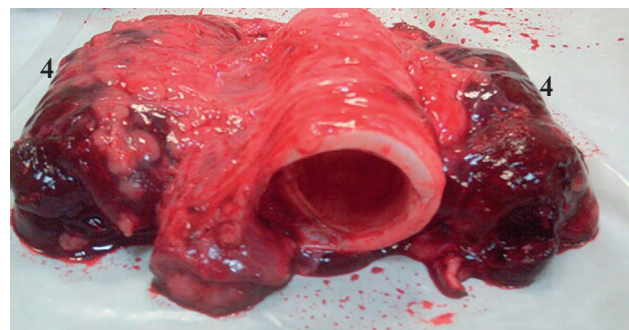
## Blood inspiration

Blood inspiration in the respiratory tract has been demonstrated, with different incidences, both in stunned-then sticked animals and not stunned (shechita/halal) animals (40) slaughtered in an up-right position. Incidences ranged as summarized below (Table 8):

**Table 8:** Blood inspiration of the slaughtered animal comparing stunning, shechita and halal

	Stunned-sticked	Shechita	Halal
Trachea: blood lines	21%	19%	58%
Trachea: red foam	0%	10%	19%
Upper bronchi: blood	31%	36%	69%

Preliminary observations conducted in a large kosher slaughterhouse in Israel, on 400 veal slaughtered in reverse position, revealed an incidence of 3% (41); this discrepancy may be caused by slaughtering in different positions and is worthy of further investigations.



Anatomical details in the vicinity of the incision are of utmost importance: the higher the location of incision (halachically lower than cricoid cartilage), the closest to each other, anatomically, the Common Carotid artery and the Vagus nerve, further than the external Jugular vein and then the internal Jugular vein. Running in a shared connective sheath with the Truncus Sympaticus, the Vagus, through its ramifications, innervates the trachea and then lungs through the pulmonary plexus, besides the heart.

When performing the shechita/halal cut corresponding to 1<sup>st</sup> CV position, the sensory nerve to the respiratory tract is severed. When the shechita/halal cut is made at a lower position- corresponding to 2<sup>nd</sup> to 4<sup>th</sup> CV, the sensory nerve may remain intact and distressful sensations could be transmitted to the brain before the animal loses sensibility. Performing the shechita cut at the anatomical position of the neck corresponding to 1<sup>st</sup> CV reduces the likelihood of irritation associated with blood aspirated into the respiratory tract. It is likely that both the Laryngeal nerves (sensory signals from the upper respiratory tract) and the Vagus nerves (signals from the lungs and lower trachea) will be severed when the neck is cut in this position. Severing the main Vagus ramification during the shechita/halal may also have important consequences in terms of welfare of the animal in the form of diminution or elimination of painful stimuli from the respiratory tract, in case of blood inspiration (23, 42).

### Unconsciousness evaluation times

The length and height of the blade, perfect sharpness, knife inclination, allow the severing of both Jugular veins and Carotid arteries, thus allowing a fast and massive blood loss, including arterial bleeding, and a sudden drop of arterial pressure to the brain (43, 44), down to 1/3 of original blood pressure in less than 2 seconds (minimum 0.36 seconds; maximum. 2.4 seconds in calves; minimum 0.6 seconds; maximum. 3.0 seconds in sheep) (43, 44). The quick drop in blood pressure, due to severing the Carotid arteries, also induces vertebral artery blood to flow towards the lowest pressure point i.e. the severed carotids, instead of flowing towards the CNS via the vertebral arteries (43, 44). The cerebral cortex is particularly sensitive to this rapid pressure fall, and consciousness is considered lost irreversibly within approximately two seconds (44). Several studies have been summarized (23) in which calves brain activity – measured by electroencephalogram (EEG) or electrocorticogram (ECG)

is lost almost immediately after shechita/halal; however there are also studies in which some animals take a relatively prolonged time to lose consciousness or develop changes in spontaneous or evoked activity (23). These data have been lastly criticized also considering the fact EEG is maintained in anesthetized animals and humans under surgery, while traces are evident even after beheading (44). The massive hemorrhage is apparently not influenced by animal position, either right up or reverse, when animals are correctly restrained. When a shochet uses a rapid cutting stroke, 95% of the calves loose posture and collapse almost immediately (18); sheep between 2 to 5 seconds; calm cattle between 10 to 15 seconds (18). The differences between cattle and sheep may be explained by differences in the anatomy of their blood vessels (18, 38, 39). Failure in severing both arteries and/or the occurrence of false aneurisms, even in one of the arteries, should be avoided with appropriate cut, due to definitely prolonged collapse time to up to 30 seconds, or even more so considering animal welfare issues (18).

### Wound management

Correct management of the time-frame between the cut and loss of consciousness is of extreme importance, in order to avoid and/or minimize any unnecessary painful stimulus to the slaughtered animal.

**Table 9:** Comparison of the laws of halacha, sharia and the OIE recommendations for wound management after slaughter

Jewish halacha	And if the slaughtered ( <i>animal</i> ) it is still twitching, it is akin to alive (45). Cutting is prohibited from an animal which is still convulsing (46) – until its soul has departed.
Islamic sharia	It is highly discouraged to do the processing or skinning of the animal while it is convulsing (27). No part of animal's body should be cut off and it should not be skinned, or thrown into boiling water, or plucked before one makes sure it is completely dead.
OIE recommendations	After incision of the blood vessels, no scalding carcass treatment or dressing procedures should be performed on the animals for at least 30 seconds or in any case until all brain-stem reflexes have ceased. The practice to remove hypothetical blood clots just after the bleeding should be discouraged since this may increase the animal's suffering.

According to Jewish halacha it is forbidden “to eat” from an animal until it is dead: »and you should not eat the soul with

*the meat*», Deuteronomy 12: 23; the interpretation is that one should wait until the soul (blood) of the animal has left. “*And really, there is no crueler thing in the world than cutting an organ or meat from the animal that is still alive...*” (47).

On the other hand, the shechita itself does not make the animal automatically suitable for consumption until the cut itself has been checked (48) through an operation called “*checking of the signs*”. The purpose of this check is to verify that in the slaughtered animal all the “signs” have been cut: trachea, esophagus, blood vessels (32, 33, 34). In poultry, where the bird being held manually during the shechita, this check is mainly visual. In ruminants the cut signs may be examined visually or by touching with the hand, which is the usual practice today, due to the fact the blood does not allow a clear view of the area. This check is mandatory in order to declare the shechita as valid, however it can be postponed according to Jewish halacha (49), and this should be the current practice from an animal welfare point of view. This is of primary importance, because touching or stimulating cut’s edges before loss of consciousness would induce pain (50). On the other hand, “*observations of hundreds of cattle and calves during kosher slaughter indicated that there was a slight quiver when the knife first contacted the throat*” (50) or even no flinching (50) or defense reflex (51). Using a perfectly sharp knife, stimulation of cut edges is minimal (14) and considered below the pain pathways activation (44) before the few seconds necessary to loose consciousness, on condition that the cut area is kept untouched and not stimulated in any way (touching; friction of cut edges; contact with objects, part of immobilizing pen, floor, exsanguination table, etc.);

cut edges should remain open and immobilized for the time requested to loss of consciousness. For this purpose, firm restraint of the head is mandatory, regardless whether the cut is performed in up-right or reverse position.

Head/chin restraint, both in the up-right or in reverse position, is also mandatory in order to allow the shochet to calibrate and perform the cut corresponding to the 1<sup>st</sup> CV, in this way also severing the Vagus nerve ramifications and reducing dramatically the incidence of arterial occlusions by retraction and blood clots.

Veterinary Services’ rules currently in Israel oblige the use of head/chin restraint; forbid touching the incision until loss of consciousness has been checked, and in any case not before 30 seconds; forbid the release from the restraining pen before loss of consciousness and in any case not before 30 seconds. Only at that point of time can carcass preparation begin (52).

## DISCUSSION

Killing a live being is never a pleasant event, and every killing system presents imprecisions which may result in the possibly of inducing pain to the animal, as also reminded by EU legislation: “*...any stunning technique presents certain drawbacks. ... pain, distress or suffering should be considered as avoidable when business operators or any person involved in the killing of animals breach one of the requirements of this regulation or use permitted practices without reflecting the state of the art, thereby inducing by negligence or intention, pain, distress or suffering to the animals*” (53).

The OIE, also, enlists main concerns and implications linked with slaughtering with/without stunning (7). Referring to slaughter with *prior stunning* the main issues are represented by stunning failures, inadequately stunning, inaccurately of shot; accurately of shot but inadequate stunning (54). Since the 1990s, USA data has quantified failures in cattle stunning between 1% (electric) to 1-5% (captive bolt) (55, 56), and up to 15%; aiming towards a 95% efficacy (5% failures) as a goal (55). Reports from UK



**Figure 8:** Head restrain in course of shechita: full and clear exposure of the neck to the shochet; head/chin-restraint remains in place until complete loss of consciousness.



summarized failures of electric stunning in sheep between 12-14%; around 5% (2,6-6,6%) in cattle (captive bolt); up to 36% in pigs (electric) (57). "Inadequate stunning" in bulls, cows, calves, may range 5% to 19% (54). Differences exist between stunning-operators (81% to 95% of accurate shots) and according to their experience (54). The time-frame reactions by operators may be several seconds, when the captive bolt is used; stun-to-stick time may be longer (70 to 294 seconds; average 105 seconds;  $116 \pm 27.4$  seconds in re-shot animals) posing serious animal-welfare concerns regarding the correct management of this time-frame (54). There is some controversy about the frequency of mis-stunning: the European Food Safety Authority (EFSA) reported that when using captive bolt stunning, 4-6,6% of cattle needed a second stun (58). Some countries dispute these figures, and it is probably true to say that the frequency of mis-stunning "is not accurately known" as candidly admitted at least in UK (59).

Concerning birds which was not the main focus of this article, just recently EFSA (European Food Safety Agency) put under discussion the efficacy of electrical baths for poultry stunning currently in use (60), and OIE (7) report up to 2% broken legs in shackled birds before electric-bath stunning. The UK Department for Environment, Food and Rural Affairs (DEFRA) underlines risks of "pre-stun shocks", due to pre-contacts with electrified water before the birds' heads completely enters the bath for stunning. The pain induced by pre-contact, resulted in the bird reacting and flapping so vigorously that it may avoid the electrified water bath and even the cutting edge for beheading. In such cases the bird is moved by the conveyor system still alive (61).

Referring to slaughter *without prior stunning* (shechita and halal) the main issues are represented by adequacy of the instrument (knife), decision, precision and position of the cut and correct management of the animal, specially immediately after the cut.

The spirit of Jewish halacha and Islamic sharia appears fully aligned with OIE recommendations aimed to avoid any unnecessary pain to animals at the time of slaughtering. The operational systems put in place by the two legislative bodies fulfill all the recommendations by OIE.

Nevertheless some techniques can definitely be improved, both in shechita and in halal (23) slaughter: more stringent accuracy concerning the cut in 1st CV position; completion and improvement of head/chin restrain equipment and restraint in general; correct wound management immediately

after the cut. All these aspects should be more accurately scrutinized and can be implemented. Shechita and halal, in fact, demand direct care to *every single slaughtered animal* (with routine check procedures for every single operation): in such a perspective economic and industrial implications are expendable and put as a second priority: the shochet is more expensive than a slaughter man; speed production is low; costs are higher, etc. Professional negligence nullifies the shechita and halal, therefore the staff is constantly scrutinized and unprofessional workers are promptly removed, due to halachic and economic implications of nullified shechita.

Abnormalities in birds slaughter are avoided with shechita, with each bird presented individually to the shochet and firmly held by the shochet (or by an assistant in case of large birds), then left bleeding until it is dead before being conveyed for preparation.

Shechita and halal, due to their intrinsic nature and due to their routine controls on every single action and for every individual animal, definitely cannot be framed as *negligent* or *intentionally* painful, distressing or inducing sufferance to animals. This may represent the moral and technical superiority of shechita and halal over conventional, mass production slaughtering systems. Mass production slaughtering systems utilize techniques and controls on *the majority* of the animals and not on every single animal, with error margins which, in principle, are insolvable (23, 54, 55, 56, 57, 58, 59, 60, 61, 62). Due to final intentions for providing cheap meat and taking into account costs implications, these errors hardly, if not at all, implicate or justify further efforts for their amelioration for the non-kosher/halal meat industry. Under these circumstances further improvements cannot possibly be reached, due to the limits of high mechanization in production lines when matched with behavioral variations in biology in the animals being slaughtered.

## REFERENCES

1. Talmud, Bava' Mezia', 32:b; 33:a – ל"ב: – בבא מציעא, ל"ב: – ג. ל"ג: א.
2. Karo Y.: Shulchan Aruch, Orach Haim, 305: 19, 1563 – שולחן ערוך אורח חיים, ש"ה: יט.
3. Baba'd, Y.: Minchat Hinuch, ch. 451, circa 1850 – באב"ד, מנחת – חינוך, תנ"א.
4. Ha Levi, A.: (of Spain; of Barcelona); Sefer Ha Chinuch, ch. 451, circa 1200 – תנ"א – ספר החינוך, תנ"א – א. הלוי (מספרד; מברצלונה), ספר החינוך, תנ"א – א.
5. Aidaros, H.: Drivers for animal welfare policies in the Middle East. Publisher OIE. Scientific and Technical Review, 33: 85-89, 2014.

6. OIE, 2014, <http://www.oie.int/en/about-us/>.
7. OIE – Terrestrial Animal Health Code – Version 7, 2014 [http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre\\_awslaughter.htm](http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_awslaughter.htm).
8. Mishna, Chullin, b. – משנה, חולין, ב. –
9. Karo, Y.: Shulchan Aruch, Yore Deha. 1:1, 1563 – שולחן ערוך יורה דעה, א' א
10. Isserless, M.: Gloss on Shulchan, Aruch, Yore Deha. 1:1, circa 1570 – הגהה על שולחן ארוך, יורה דעה, א' א רבי משה בן ישראל איסרליש – (הרמ"א).
11. Palagi (Palaci), H.: Kaf Ha Haym. 24:26, circa 1850 – ח. פלגי, כך החיים, ב"ד: בו
12. Karo, Y.: Shulchan Aruch, Yore Deha. 6:4, 1563 – שולחן ערוך – יורה דעה, ו' ד
13. Palagi (Palaci), H.: Kaf Ha Haym, 100:34, 37, circa 1850 – ח. פלגי, כך החיים, ק': לד לו
14. Grandin, T.: The rules of Shechita for performing a proper cut during kosher slaughter. <http://www.grandin.com/ritual/rules.shechita.proper.cut.html>
15. Adelman, G.: "Controversy and Crisis: Studies in the History of the Jews in Modern Britain", Publisher: Academic Studies Press, Brighton (MA), USA.
16. Stoppelman, J. W. F.: "De anti-shechita propaganda en haarbestrijding" on "De Vrijdagavond. JoodschWeekblad". 51: 804-907, March, 1928.
17. Hoffman, Y.: "The Shechita wars" on "Vos Iz Neias". 2012. <http://www.vosizneias.com/98200/2012/01/04/new-york>
18. Grandin, T. and Regenstein J.: "Religious slaughter and animal welfare: a discussion for meat scientists" in "Meat Focus International". 115-123, March, 1994.
19. Velarde, A., Rodriguez, P., Dalmau, A., Fuentes, C., Lloncha, P., van Holleben, K.V., Anil, M.H., Lambooj, J.B., Pleiter, H., Yesildere, T. and Cenci-Goga, B.T.: Religious slaughter: Evaluation of current practices in selected countries. *Meat Sci.* 96: 278-287, 2014.
20. Grandin, T.: Euthanasia and slaughter of livestock. *JAVMA.* 204: 1354-1360, 1994.
21. Mendoza, A.: Dinim de Shechita y Bedica. London, publisher unknown. K.K. Sahar Shamaim, A. (Spanish-Portuguese Community of London), 1733.
22. Al-Watania Poultry. <https://www.youtube.com/watch?v=8f8ZI--t4NQ>
23. Nakyinsige, N.K., Che Man, Y.B., Aghwan, Z.A., Zulkifli, I., Goh, Y.M., Abu Bakar, F., Al-Kahtani, H.A. and Sazili, A.Q.: Stunning and animal welfare from Islamic and scientific perspectives. *Meat Sci.* 95: 352-361, 2013.
24. Karo, Y.: Shulchan Aruch, Yore Deha, 3:1, 1563 – שולחן ערוך יורה דעה, ג' א
25. Karo, Y.: Shulchan Aruch, Yore Deha, 17:1, 1563 – שולחן ערוך – יורה דעה, י"ז: א
26. Karo, Y.: Shulchan Aruch, Yore Deha, 31:1, 1563 – שולחן ערוך – יורה דעה, ל"א: א
27. Zikrullah, A.L.: The theory of Shariah Rulings in Halal Meat and Poultry Production. *Intern. J. Manag. Sci.* 3: 351-369, 2014.
28. Isserless, M.: Gloss on Shulchan, Aruch, Yore Deha, 8:1, circa 1570 – רבי משה בן ישראל איסרליש (הרמ"א), הגהה על שולחן ארוך, – יורה דעה, ח': א
29. Talmud, Hullin, 17: b – תלמוד בבלי, חולין, י"ז: ב –
30. Karo, Y.: Shulchan Aruch, Yore Deha, 18:3, 1563 – שולחן ערוך – יורה דעה י"ח: ג
31. Ibn Sharaf An-Nawawi, Y.: "Forty Hadiths", Hadith 17, circa 1250. <http://40hadithnawawi.com>
32. Talmud, Hullin, 28: a – תלמוד בבלי, חולין, כ"ח: א –
33. Rabenu Hananel, glosses, Hullin, 28:b, circa 1000 – רבינו חננאל, – עיונים על חולין כ"ח: ב
34. Ha Levi Segal, D.: Turei Zahav on Shulchan Aruch, Yore Deah, 22: 8, circa 1600 – ד. הלוי, טורי זהב על שולחן ארוך, יורה דעה, כ"ב: ח –
35. The Quran, Surat Al-Mā'idah, 5:3 (Sahih International), <http://quran.com>
36. Genesis, 9:4; Leviticus, 3:17; Leviticus 17:10, 12; Deuteronomy, 12:22, 25 – בראשית ט: ד; ויקרא ג: י"ז; ויקרא י"ז: י-י"ב; דברים י"ב: ב – כ"ב-כ"ה
37. Karo, Y.: Shulchan Aruch, Yore Deha, 20:1, 2, 1563 – שולחן ערוך – יורה דעה, כ': א ב
38. Gregory, N.G., von Wenzlawowicz, M., Alam, R.M., Anil, H.M., Yesildere, T. and Silva-Fletcher, A.: False aneurysms in carotid arteries of cattle and water buffalo during shechita and halal slaughter. *Meat Sci.* 79: 285-288, 2008.
39. Grandin, T.: Cattle should be cut in the cervical (C1) position to improve welfare during Kosher and Halal slaughter without stunning. 2012. <http://www.grandin.com/ritual/cattle.cut.jawbone.improve.welfare.html>
40. Gregory, N.G., von Wenzlawowicz, M. and von Holleben, K.: Blood in the respiratory tract during slaughter with and without stunning in cattle. *Meat Sci.*, 82: 13-16, 2009.
41. Geraisy, W. and Pozzi, P.: Bleeding in slaughter without stunning – at "Improved Animal Welfare Program", OIE & Veterinary Services – Israel", Conference Acts, Bet Dagan, Israel, Dec. 10<sup>th</sup> 2014, <http://www.vetserv.moag.gov.il/Vet/Yechidot/TzaarBaley-Chaim/default.htm>
42. Gregory, N.G., von Wenzlawowicz, M., von Holleben, K., Fielding, H.R., Gibson, T.J., Mirabito, L. and Kolesar, R.: Complications during shechita and halal slaughter without stunning in cattle. *Animal Welfare* 21: 81-86, 2012.
43. Levinger, M.: Blood pressure in the animal after shechita and blood flow in vertebral artery as a consequence. In "Shechita and cruelty to animals", pp. 62-68; Publisher Maskil le-David, Jerusalem, Israel, 2004.
44. S.D. Rosen, S.D.: Physiological insights into Shechita. *Vet. Rec.* 154: 759-765, 2004.
45. Talmud, Hullin, 30: a – תלמוד בבלי, חולין, ל': א –
46. Karo, Y.: Shulchan Aruch, Yore Deha, 27: 1, 1563 – שולחן ערוך – יורה דעה, כ"ז: א
47. Ha Levi A.: (of Spain; of Barcelona), Sefer Ha Chinuch, ch. 452, circa 1200 – א. הלוי (מספרד; מברצלונה), ספר החינוך, תנ"ב –
48. Karo, Y.: Shulchan Aruch, Yore Deha, 25:1, 1563 – שולחן ערוך – יורה דעה, כ"ה: א
49. Isserless, M.: Gloss on Shulchan Aruch, Yore Deha, 25: 1, 1563 – הגהה על שולחן ארוך, יורה דעה, כ"ה: א רבי משה בן ישראל איסרליש – (הרמ"א).
50. Grandin, T.: Euthanasia and slaughter of livestock. *JAVMA.* 204: 1354-1360, 1994 <http://www.grandin.com/ritual/euthanasia.slaughter.livestock.html>

51. Candotti, P., Diegoli, G.: "Ritual slaughtering" on "La globalizzazione aspetti sanitari e socio culturali derivanti" Reggio Emilia (IT), Conference Acts, April, 2009. <http://www.ausl.re.it/comunicazione/congressi/1711173-venerd-3-aprile-2009-convegno-la-globalizzazione-aspetti-sanitari-e-socio-culturali-derivanti-la-mac.html>
52. Israel Ministry of Agriculture – The Veterinary Services – Animal Products Control Department. Rule 3.8.1, "Prevention of Animal Suffering in the Course of Slaughtering". 2014. <http://foodsafety.co.il/dapeiNoal/dapeinoalUnit.aspx?ID=304>
53. Council Regulation (EC) 1099: "Protection Of Animals At The Time Of Killing" 2009.
54. Atkinson, S., Velarde, A. and Algers, B.: Assessment of stun quality at commercial slaughter in cattle shot with captive bolt. *Animal Welfare*, 22: 473-481, 2013.
55. Grandin, T.: Objective scoring of animal handling and stunning practices at slaughter plants. *JAVMA*. 212: 36-39, 1998.
56. Grandin, T.: "Surveys of Stunning and Handling in Slaughter Plants", 2011, <http://www.grandin.com/survey/survey.html>
57. K. Fowler, "An Animal Aid Investigation into UK Slaughterhouses", Published by Animal Aid. ISBN: 978-1-905327-19-5, 2009. <http://www.animalaid.org.uk/images/pdf/slaughterreport.pdf>
58. European Food Safety Authority (EFSA), "Welfare aspects of animal stunning and killing methods - Scientific Report of the Scientific Panel for Animal Health and Welfare on a request from the Commission related to welfare aspects of animal stunning and killing methods". AHAW/04-027; Question-2003-093; *EFSA Journal* 45: 90, 2004. <http://www.efsa.europa.eu/en/efsajournal/doc/45.pdf>
59. Trees, L. and Jordan, H.: *Animal Welfare and Non-stun Slaughter-Key Facts*. Veterinary Policy Research Foundation. 2014. <https://vprf.wordpress.com/2014/07/18/animal-welfare-and-non-stun-slaughter>
60. European Food Safety Agency, (EFSA) "Scientific Opinion on electrical requirements for poultry water bath stunning equipment", *EFSA Journal*. 12: 3745, 2014. <http://www.efsa.europa.eu/en/efsajournal/doc/3745.pdf>
61. Department for Environment, Food and Rural Affairs Report: "The Welfare of Poultry at Slaughter or Killing", Publisher: DEFRA, London, UK, 2007. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/69473/pb13539-welfare-poultry-slaughter.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69473/pb13539-welfare-poultry-slaughter.pdf)
62. Zivotofsky, A. Z. and Strous, R.S.: A perspective on the electrical stunning of animals: are there lessons to be learned from human electro-convulsive therapy (ECT)? *Meat Sci*. 90: 956-961, 2012.