

Consciousness at slaughter with and without stunning

Luigi Iannetti

IZS Teramo & SCAW/SLU– WOAH Collaborating Centre for Animal Welfare

**WOAH National Focal points for AW. Regional training workshop for
Europe**

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Summary

- Consciousness according to the WOAH standard on animal welfare during slaughter (TAHC chap. 7.5)
- Stunning methods in the different species and consciousness assessment
- Slaughter without stunning
- Research projects/recent publications
- Conclusions

CHAPTER 7.5.

ANIMAL WELFARE DURING SLAUGHTER

Article 7.5.1.

Introduction

Providing good welfare to animals at *slaughter* is ethically and economically beneficial. The implementation of *animal welfare* measures, in addition to giving value to the product directly for ethical reasons, contributes to the improvement of workers' wellbeing, health and safety. This will also contribute to food safety and product quality, and consequently to the improvement of economic returns.

Article 7.5.2.

Scope

This chapter identifies *hazards* to *animal welfare* during *slaughter* and provides recommendations for arrival and *unloading*, *lairage*, handling, *restraint*, *stunning* and bleeding of animals in *slaughterhouses/abattoirs*. It provides animal-based measures to assess the level of welfare and recommends remedial and corrective actions to be applied, when necessary.

This chapter applies to the *slaughter* in *slaughterhouses/abattoirs* of free-moving animals, such as ruminants, camelids, equids and pigs, and animals in *containers* such as rabbits and most *poultry* species.

This chapter should be read in conjunction with the guiding principles for *animal welfare* provided in Chapter 7.1. and Chapter 7.14. and with relevant provisions of Chapters 6.2. and 6.3.

Article 7.5.3.

Definition

Available online: https://www.woah.org/fileadmin/Home/eng/Health_standards/tahc/2023/chapitre_aw_slaughter.pdf

Animal welfare definition according to TAHC chapter 7.1

Animal welfare means the physical and mental state of an animal in relation to the conditions in which it lives and dies.

This is the latest definition (since 2018), previously it was “how an animal copes with the conditions in which it lives”.



Animal welfare during slaughter (TAHC chapter 7.5): general principles

Providing good welfare to animals at slaughter is ethically and economically beneficial. [...] giving value to the product directly for ethical reasons [...] improvement of workers wellbeing, health and safety. This will also contribute to food safety and product quality [...]

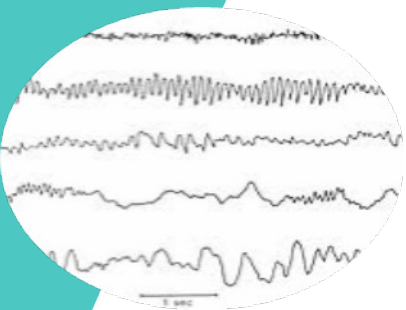
This chapter identifies **hazards to animal welfare during slaughter** and provides **recommendations** for arrival and unloading, lairage, handling, restraint, **stunning and bleeding** of animals in slaughterhouses/abattoirs. **It provides animal-based measures to assess the level of welfare** and recommends remedial and corrective actions to be applied, when necessary.

Definitions

- **Slaughter** means any procedure that causes the death of an animal by bleeding
- **Stunning** means any procedure that causes loss of consciousness for the purpose of killing without avoidable distress, fear and pain.
- **Bleeding** means the act of severing major blood vessels that supply the brain, to ensure death.

Definitions

- No definition of **consciousness** or **unconsciousness** is directly provided by WOAH
- Unconsciousness is a state of unawareness (loss of consciousness) in which there is ***temporary or permanent disruption to brain function***. As a consequence the individual is unable to respond to normal stimuli, including pain (Dialrel project 2008)



More details on stunning according to TAHC 7.5

- means any mechanical, electrical, chemical or other procedure that causes immediate loss of consciousness; when used before slaughter, the **loss of consciousness lasts until death from the slaughter process**; in the absence of slaughter, the procedure could allow the animal to recover consciousness
- The stun-stick interval, as well as the bleeding time, are therefore crucial



General principles for Stunning

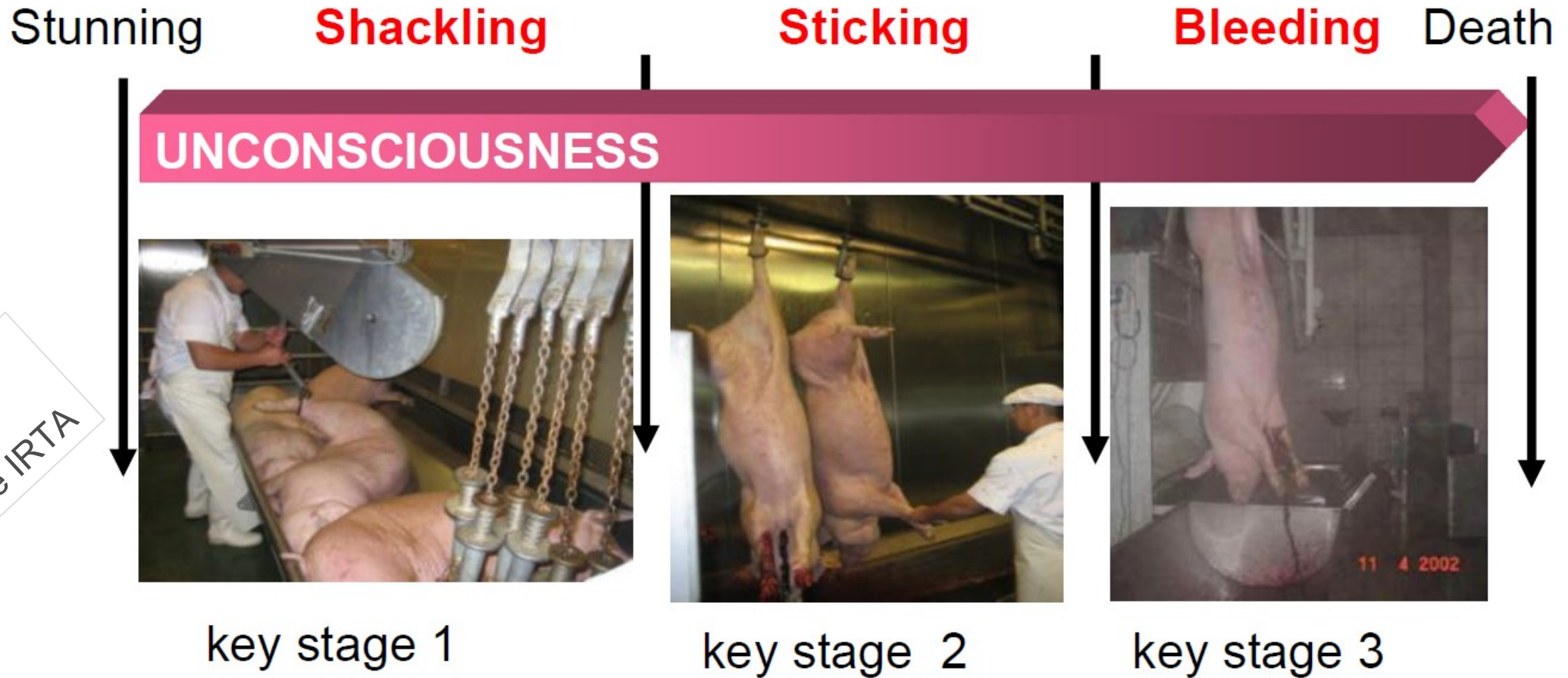
- *Prevents distress, fear and pain to animals during neck cutting and bleeding*
- The most common methods are mechanical, electrical and exposure to controlled atmosphere.
- The **main animal welfare concern** associated with stunning is '*ineffective stunning*' which results in distress, fear and pain, during induction of unconsciousness and possible recovery before death.



General recommendation for stunning and ABMs

- In the **WOAH TAHC 7.5** all the stunning methods are listed, including ABMs to check effective or ineffective stun
- **Main recommendations** are also reported, including:
 - ✓ Be stunned as soon as they are restrained.
 - ✓ Ineffective stunning or recovery:
 - Re-stun immediately using a backup method
 - Systematically recorded and the cause of the failure identified and rectified
 - ✓ Stunning equipment should be used, cleaned, maintained and stored following manufacturer's recommendations.
 - ✓ Regular calibration
 - ✓ Training and Standard operating procedures

Assessment of the state of consciousness



Courtesy of
Antonio
Velarde IRTA

Animal based measures to check effective stunning

- **Multiple indicators** should be used to determine whether a stun is **effective** and the animal is unconscious.
- After stunning, the **state of consciousness** is assessed to identify if animals are successfully rendered unconscious or if they are conscious (e.g. stunning was ineffective or they recovered consciousness) and therefore at risk of experiencing distress, fear and pain.
- For each **animal-based measure** of state of consciousness, outcomes either suggesting **unconsciousness** (e.g. presence of tonic seizures) or suggesting **consciousness** (e.g. absence of tonic seizures) have been identified for each stunning method.



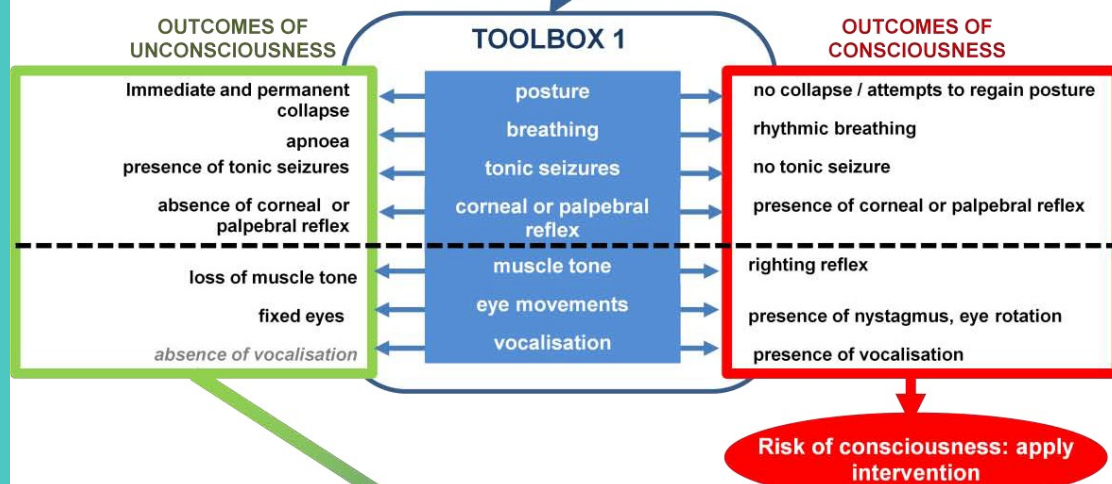
EFSA opinions on monitoring procedures at slaughterhouses

- A number of different opinions have been published by EFSA regarding welfare during slaughtering in the different species
- **Specifically regarding consciousness**, two opinions are available since **2013** regarding different consciousness indicators available in literature for **cattle and small ruminants**
- <https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2013.3460>
- <https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2013.3522>

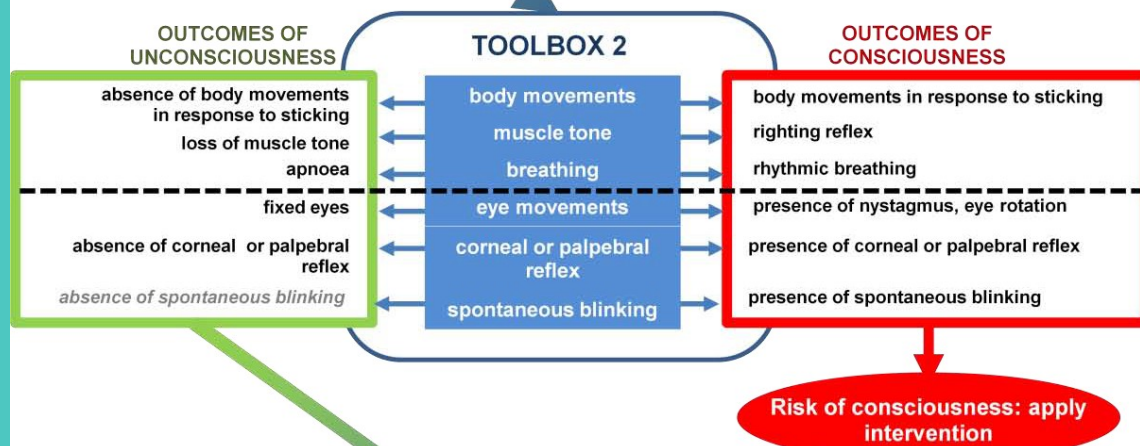
EFSA opinions on monitoring procedures at slaughterhouses

BOVINES - SLAUGHTER WITH STUNNING (CAPTIVE BOLT)

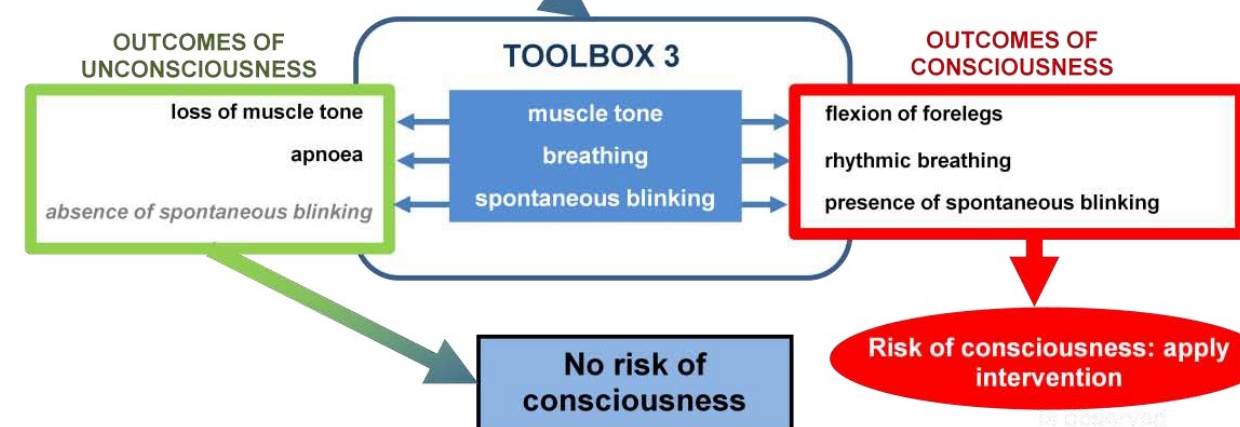
Key Stage 1 (between end of stunning and shackling): check for outcomes of consciousness



Key Stage 2 (during neck cutting or sticking): check for outcomes of consciousness



Key Stage 3 (during bleeding): check for outcomes of consciousness



Animal-based indicators for each «key stage» after stunning are reported in 3 “toolbox”

EFSA opinions on monitoring procedures at slaughterhouses

Indicators after captive bolt stunning	Outcomes of consciousness	Sensitivity (%)	Data (without uncertainty), average (20 th , 50 th and 80 th percentiles)	Specificity (%)	Data (without uncertainty), average (20 th , 50 th and 80 th percentiles)	Feasibility		
						After stunning	During neck cutting	During bleeding
Posture ^(a)	No collapse or attempts to regain posture	54	53 (10, 50, 90)	98	98 (95, 100, 100)	0.96	0.75	0.38
Breathing	Presence of breathing	72	71 (43, 93, 100)	97	97 (95, 100, 100)	0.55	0.38	0.29
Tonic seizure ^(b)	Absence of tonic seizures	91	9 (95, 100, 100)	100 (SR 97)	97 (95, 100, 100)	0.80	0.25	0.29
Muscle tone	Presence of muscle tone	81	84 (80, 100, 100)	75	70 (10, 95, 100)	0.36	0.22	0.36
Response to nose prick or ear pinch	Positive response	70	70 (n.a.)	92	91 (n.a.)	-0.25	-0.25	-0.67
Body movements	Presence of movements	71	72 (55, 90, 100)	28	33 (0, 0, 80)	0.92	0.73	0.50
Vocalisation	Presence of vocalisation	45	46 (21, 30, 88)	98	98 (95, 99, 100)	0.65	0.41	0.41
Eye movements	Presence of eye movements	65	65 (45, 85, 100)	95	94 (89, 95, 100)	0.48	-0.11	0.16
Palpebral reflex	Presence of reflex	73	79 (75, 100, 100)	100 (SR 96)	96 (92, 98, 100)	0.00	-0.38	-0.15
Corneal reflex	Presence of reflex	91	91 (98, 100, 100)	100 (SR 97)	97 (94, 98, 100)	0.32	-0.35	-0.29
Spontaneous blinking	Presence of blinking	77	79 (60, 90, 100)	98	97 (94, 99, 100)	0.56	0.21	0.13
Pupillary reflex	Presence of reflex	85	84 (80, 100, 100)	97	96 (93, 95, 100)	0.00	-0.67	-0.44

List of consciousness indicators in slaughter with stunning, including **sensitivity** («ability to identify true positives»), **specificity** (“ability to identify true negatives”) and **feasibility**.

Similar table is available for slaughter without stunning

Mechanical stunning (WOAH 7.5.17)

- mostly **cattle**
- **Animal welfare concerns:** ineffective stunning or short-lasting unconsciousness
- **main hazards:**
 - ✓ incorrect shooting position and incorrect direction of the impact.
 - ✓ Absence of or incorrect restraint
 - ✓ Poor maintenance of the equipment or inadequate cartridge power or air line pressure
 - ✓ Inappropriate use of cartridge, narrow bolt diameter or short length of bolt
 - ✓ Animals with thicker skull

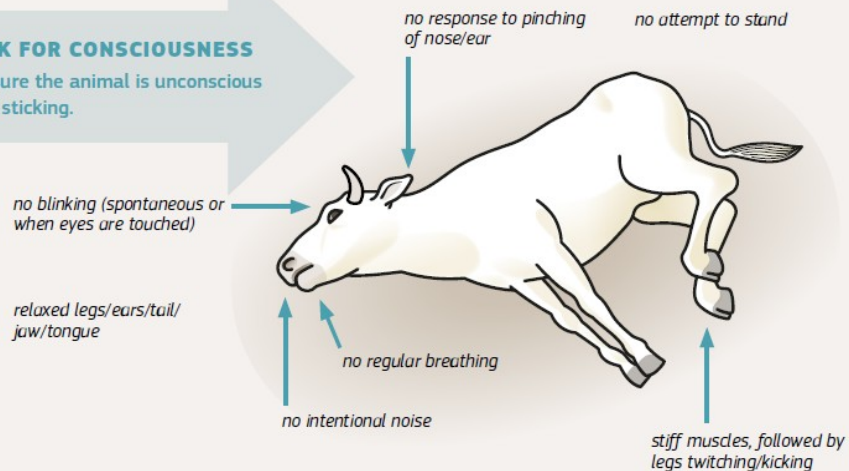


Mechanical stunning (WOAH 7.5.17)

- **ABMs** to be considered:
- ✓ **Effective stun:** *immediate collapse*; apnoea; tonic-clonic seizure; absence of corneal or palpebral reflex; absence of eye movements.
- ✓ **Ineffective stun or recovery of consciousness:** absence of collapse or attempts to regain posture; rapid eye movement or nystagmus; vocalisation; spontaneous blinking; righting reflex; presence of corneal or palpebral reflex; rhythmic breathing.

CHECK FOR CONSCIOUSNESS

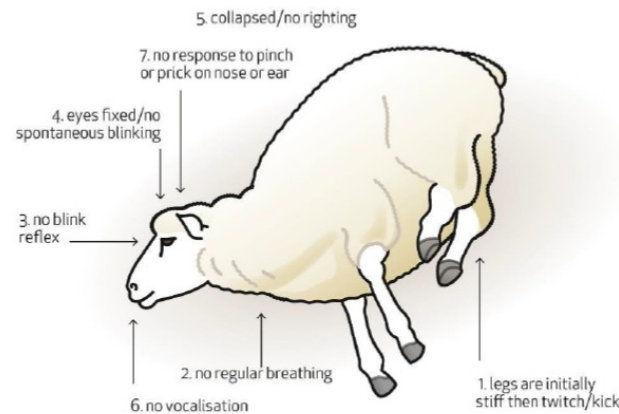
Make sure the animal is unconscious before sticking.



Electrical stunning (WOAH 7.5.18)

- mostly **sheep, swine (free-moving), poultry (water-bath)**
- **AW concerns:** application of an electric current across the brain of **sufficient magnitude** to induce immediate unconsciousness. Inverted position (water bath used in birds)
- **Main hazards** to be considered:
 - ✓ Incorrect electrode placement
 - ✓ Poor contact
 - ✓ High contact resistance (e.g wool or dirt)
 - ✓ Dirty or corroded electrode
 - ✓ Low voltage/current or high electrical frequency
 - ✓ Entry in the water-bath (birds) with incorrect angle
 - ✓ Water level (birds)





Electrical stunning (WOAH 7.5.18)

- **ABMs** to be considered:
- ✓ **Effective stun:** presence of tonic-clonic seizure; apnoea, absence of corneal or palpebral reflex; absence of spontaneous blinking
- ✓ **Ineffective stun or recovery of consciousness:** Presence of breathing, absence of collapse or attempts to regain posture; presence of spontaneous blinking; vocalizations, righting reflex; presence of corneal or palpebral reflex.

Controlled atmosphere stunning(WOAHA 7.5.18)



- mostly **pigs, poultry**
- **carbon dioxide, inert gases, mixtures of carbon dioxide with inert gases or low atmosphere pressure (LAPS)**
- **AW concerns:** Loss of consciousness is not immediate
- **Main hazards:**
 - ✓ Irritant or aversive gas mixtures
 - ✓ Low gas temperature and humidity
 - ✓ Overloading of the gondola/crate
 - ✓ Incorrect gas concentration
 - ✓ Too short gas exposure time.

Controlled atmosphere stunning(WOAH 7.5.18)

- **ABMs** to be considered:
- ✓ **Effective stun:** presence of tonic-clonic seizure; apnoea, absence of corneal or palpebral reflex; absence of spontaneous blinking
- ✓ **Ineffective stun or recovery of consciousness:** Presence of breathing, absence of collapse or attempts to regain posture; presence of spontaneous blinking; vocalizations, righting reflex; presence of corneal or palpebral reflex.



Slaughter without stunning

- Commonly carried out in the framework of **religious slaughter** (Islamic and Jewish)
- **Loss of consciousness** and death onset **only due to bleeding**
- Allowed in EU in derogation to reg. 1099/2009 (art. 4)
- Some EU countries (e.g. Sweden) have decided to not allow it anyway
- Specific recommendations in WOAH standards in relation to animal welfare



Slaughter without stunning

CHAPTER 7.5.

ANIMAL WELFARE DURING SLAUGHTER

Article 7.5.1.

WOAH Terrestrial Animal Health Code

The last version (2024) does not include a specific chapter on slaughter without stunning, but there are many specific recommendations throughout the standard

Slaughter without stunning

Article 4

Stunning methods

1. Animals shall only be killed after stunning in accordance with the methods and specific requirements related to the application of those methods set out in Annex I. The loss of consciousness and sensibility shall be maintained until the death of the animal.
4. In the case of animals subject to particular methods of slaughter prescribed by religious rites, the requirements of paragraph 1 shall not apply provided that the slaughter takes place in a slaughterhouse.

EC Regulation 1099/2009 on the protection of animals at the time of killing

In derogation to art. 4, in religious rites it is possible to not stun the animal, but all the other requirements must be followed



UNCONSCIOUS

STUNNING

CUT

Courtesy of Sara Rota
Nodari IZSLER



Courtesy of Sara Rota
Nodari IZSLER



CRITICAL POINTS

1. RESTRAINT

2. CUT

3. BLEEDING-DEATH

Courtesy of Sara
Rota Nodari IZSLER

Critical animal welfare concerns in relation to slaughter without stunning

① **Animal restraint prior to slaughter**

TERAMO

WOAH Collaborating Centre
for animal welfare

Reference Centre
 World Organisation
for Animal Health
To protect and improve the health of animals and people

Regulation (EC) No 1099/2009

Systems restraining bovine animals by inversion or any unnatural position shall not be used except in the case of animals slaughtered in accordance with Article 4(4) (Possible derogation for religious slaughter).



WOAH Terrestrial Animal Health Code.

Chap. 7.5 Animal Welfare during slaughter. Art. 7.5.15

Restraint

Slaughter without stunning increases the risk of *pain* and fear due to the need for robust *restraint* of conscious animals for neck cutting, especially if animals are turned on their sides or backs.

In case of *slaughter without stunning*, the restrainer should restrain the head and should support the body of the animal.

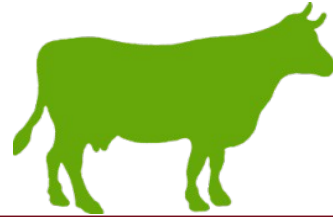
The restraint should be maintained until the animal is unconscious.

When restrainers that hold an animal with its feet off the floor are used, the animal should be held in a balanced, comfortable, upright position.

When a restrainer is used to rotate an animal from an upright position, the body and head should be securely held and supported to prevent struggling and slipping within the device.



R E S T R A I N T



- **INDIVIDUAL**
- **MECHANICAL**



A device that restricts both the lateral and vertical movement of the head of the animal and are adjustable to be adapted to the size of the animal.

- **INDIVIDUAL**
- **MECHANICAL**
- **MECHANICAL HEAD RESTRAINT**

Courtesy of Sara
Rota Nodari IZSLER



Courtesy of Sara
Rota Nodari IZSLER

R E S T R A I N T

NOT ALLOWED



- **INDIVIDUAL**
- **MECHANICAL**
- **MECHANICAL HEAD RESTRAINT**

**NOT
COMPLIANT
WITH EU
REGULATION**

Annex III reg. 1099/2009:

- **bovine animals must be individually mechanically restrained before slaughter without stunning;**
- **the restraining equipment must be designed and maintained to minimize pain and distress;**
- **the animal's head must be restrained until the neck cut has been completed;**
- **after the neck cut, the restraint must not be released until the animal has lost consciousness**



UPRIGHT RESTRAINT

R
E
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- INDIVIDUAL
- MECHANICAL

THE ANIMAL MUST BE SUPPORTED BUT NOT LIFTED

Courtesy of Sara
Rota Nodari IZSLER

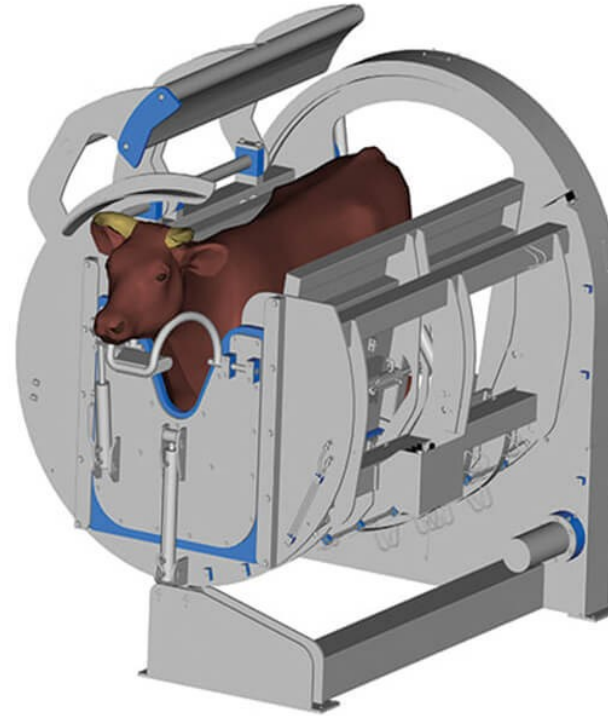




ROTATING RESTRAINT



R
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- **INDIVIDUAL**
- **MECHANICAL**
- **MECHANICAL HEAD RESTRAINT**

Courtesy of Sara
Rota Nodari IZSLER





ROTATION: RECOMMENDATIONS



**R
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Courtesy of Sara
Rota Nodari IZSLER

- **ROTATE ONLY 90°**
- **ROTATE 90° AFTER THE CUT IN CASE OF 180° ROTATION**
- **RELEASE SOME PREASSURE AFTER ROTATION**

The scientific literature identifies potential welfare concerns related to restraint systems (upright and rotary), which are dependent on **equipment design, operational management and operator competence**.

Upright

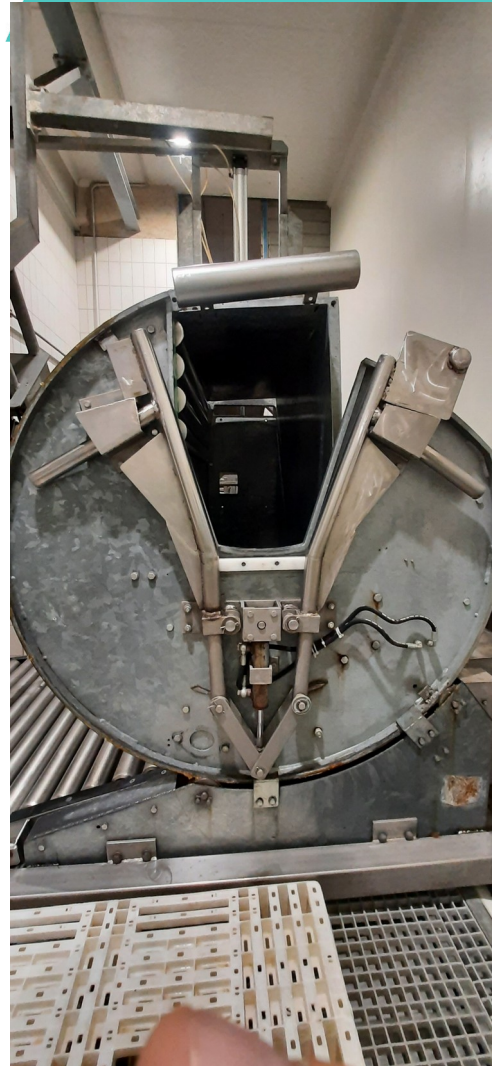
- Excessive pressure on the animal's body
- Hyperextension of the neck, associated with difficulties in performing an effective cut
- Wound irritation due to contact with metal parts of the neck
- Variability in the number of cuts performed (2–12; extreme cases up to 25)
- Blood aspiration

Rotated on the back ($\approx 180^\circ$)

- Longer time intervals from entry to full restraint and to neck cutting.
- Pressure of the rumen on the diaphragm and thoracic organs.
- Blood entering the larynx and trachea
- Potential airway irritation in conscious animals

Rotated on the side ($\approx 90^\circ$)

- **Generally less stressful** than the supine position, with reduced respiratory compromise.
- Pressure on internal organs
- Additional operational challenges may arise: post-cut wound management and adaptation of the cutting technique



Pozzi, P. S., Geraisy, W., Barakeh, S., & Azaran, M. (n.d.). Principles of Jewish and Islamic slaughter with respect to OIE (World Organization for Animal Health) recommendations. Ministry of Agriculture and Rural Development, Veterinary Services and Animal Health

Dott. Michele Podaliri Vulpiani- Istituto Zooprofilattico Sperimentale dell'Abruzzo e Molise Giuseppe Caporale

Velarde, A., & Dalmau, A. (2018). *Slaughter without stunning*. In J. A. Mench (Ed.), *Advances in agricultural animal welfare* (pp. 221–240). Woodhead Publishing. <https://doi.org/10.1016/B978-0-08-101215-4.00012-2>



Halal Slaughter Watch. (2017, *December 18*; aggiornato 2024, *April 5*). *Inspection of Tekirdag slaughterhouse, Turkey.* <https://www.halal-slaughter-watch.org/inspection-tekirdag-slaughterhouse-turkey/>

Critical animal welfare concerns in relation to slaughter without stunning

① Animal restraint prior to slaughter

Objectives

- EEG and ECG analysis of veal calves: effects of restraint device rotation and neck cutting or stunning

Materials & Methods

- 31 veal calves
- Neck cutting without stunning
- Captive bolt stunning followed neck cutting
- Electrical stunning followed by neck cutting
- Restraint device rotated at 90°, 120° or 180°
- EEG and ECG monitoring during restraint rotation and neck cutting

Results



Rotation of the restraint device **compromises calf welfare** as shown by increased heart rate and blood parameter changes indicating acute stress responses.



Meat Science
Volume 91, Issue 1, May 2012, Pages 22-28



Restraining and neck cutting or stunning and neck cutting of veal calves

E. Lambooij, J.T.N. van der Werf, H.G.M. Reimert, V.A. Hindle

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<https://doi.org/10.1016/j.meatsci.2011.11.041>

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Critical animal welfare concerns in relation to slaughter without stunning

② Neck cutting without stunning



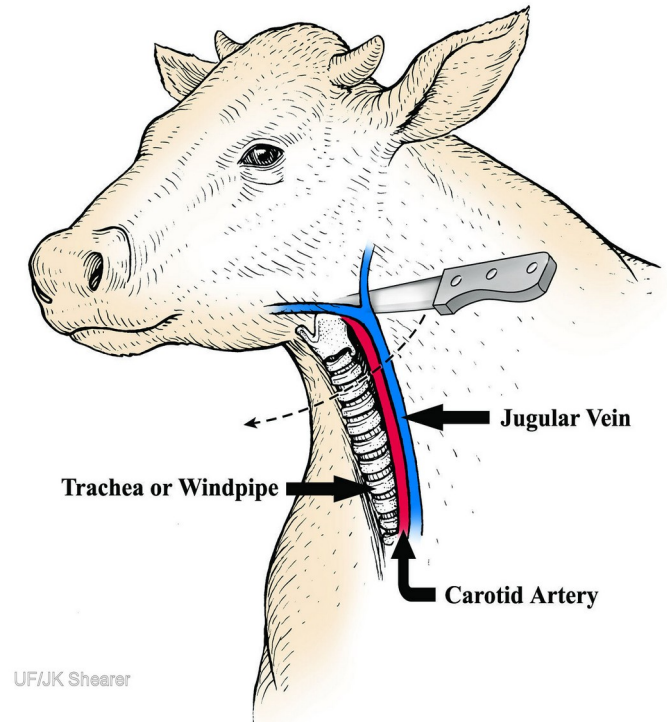
- Potential nociceptive stimulation may occur if the animal is conscious



- Loss of consciousness is not instantaneous and may be delayed



- Precision and quality of the cut influence bleeding efficiency and time to unconsciousness



<https://calfcare.ca/management/health-and-welfare/treatment-and-prevention/approved-methods-of-euthanasia-in-calves/>

Neck cutting: nociceptors

Bleeding without prior *stunning* causes *animal* suffering because the incision to sever blood vessels results in substantial tissue damage in areas well supplied with nociceptors. The activation of these nociceptors causes the *animal* to experience *pain*. Loss of consciousness due to bleeding is not immediate and there is a period during which the *animals* experience fear, *pain* and *distress*. This period will be reduced by applying *stunning* immediately after neck cutting.

Absence of or ineffective *stunning* may result in *animals* being released from the *restraint*, shackled, and bled and/or further processed while they are still conscious or have the potential to recover consciousness.

Critical animal welfare concerns in relation to slaughter without stunning

2

Neck cutting without stunning

Research from Gibson et al. (2009):

- Calves in dorsal recumbency
- flat-edged knife 245 mm long by 28 mm wide (in Shechita it is about 400 mm long by 50 mm wide)
- demonstrated with EEG that there is a period following slaughter where ventral-neck incision represents a noxious stimulus

Scientific Article

Electroencephalographic responses of halothane-anaesthetised calves to slaughter by ventral-neck incision without prior stunning

TJ Gibson^{*†‡}, CB Johnson^{*‡§}, JC Murrell^{‡#}, CM Hulls^{*¥}, SL Mitchinson^{*‡}, KJ Stafford^{*‡},
AC Johnstone[‡] and DJ Mellor^{*¥}

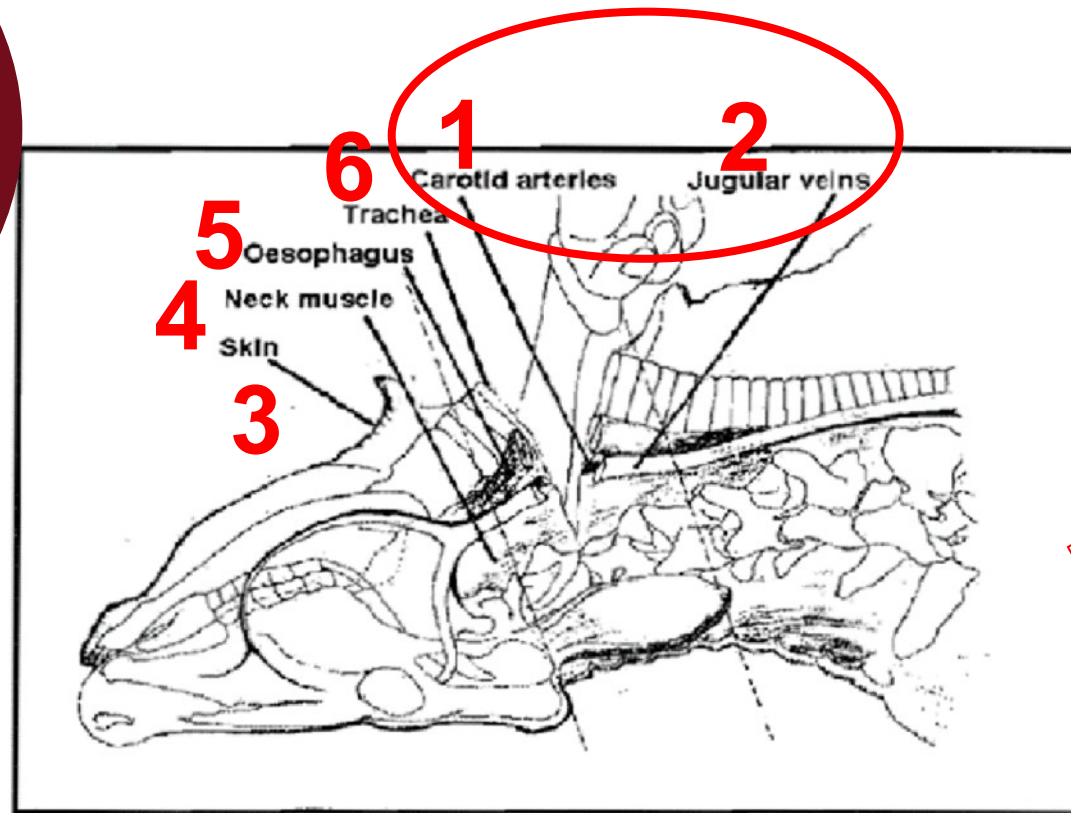


CUT



NECK
INCISION IS
DONE WITH
MINIMAL
DAMAGE

SINGLE CUT!!!



Courtesy of Sara
Rota Nodari IZSLER



KNIFE



- RAZOR SHARP BLADE
- FREE OF ANY DENT OR IMPERFECTION

- WIDTH OF THE BLADE
- NO TIP/POINT

Courtesy of Sara
Rota Nodari IZSLER

Precision and quality of the cut influence bleeding efficiency and time to unconsciousness (shechita)



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World Organisation
for Animal Health
Fa. animal res. OIE

Must be extremely sharp and perfectly smooth to enable a continuous and uninterrupted cut.

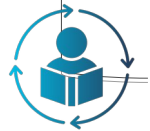


Knife Sharpness Testers - Anag
o

CHALEF



Regularly inspected for imperfections under religious supervision



The shochet is trained in anatomy and proper handling of the chalef



Dott. Michele Podaliri Vulpiani- Istituto
Zooprofilattico Sperimentale
dell'Abruzzo e Molise Giuseppe
Canorale

3

Bleeding efficiency

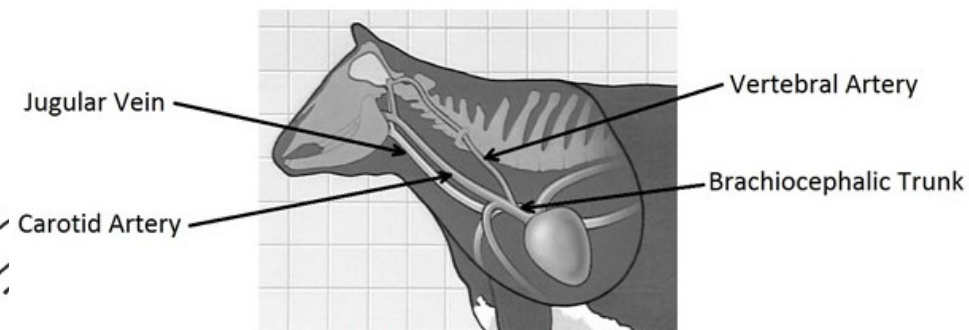
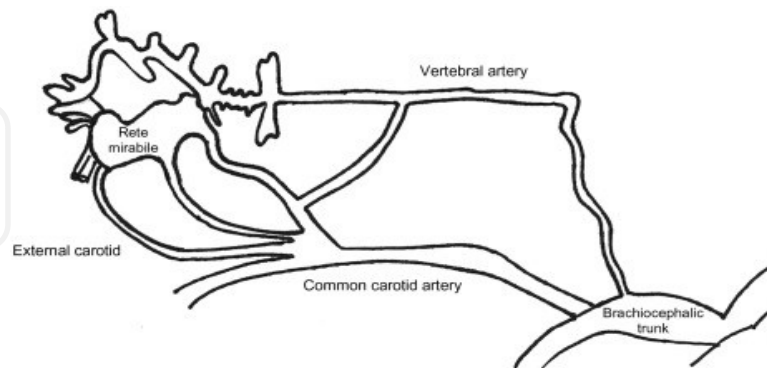
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T E R A M O

W
fo
Ref

There is evidence in literature that loss of consciousness is not instantaneous and may be delayed, particularly in cattle

Collateral
circulation



Example: False aneurysm



False aneurysm

Velarde, A., & Dalmau, A. (2018). *Slaughter without stunning*. In J. A. Mench (Ed.), *Advances in agricultural animal welfare* (pp. 221–240). Woodhead Publishing. <https://doi.org/10.1016/B978-0-08-101215-4.00012-2>

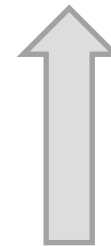
Humane Slaughter Association. (n.d.). Bleeding. Retrieved June 2025, from <https://www.hsa.org.uk/bleeding/bleeding-1>

von Holleben, K., von Wenzlawowicz, M., Gregory, N., Anil, H., Velarde, A., Rodríguez, P., Cenci Goga, B., & Lambooij, B. (2010). *Veterinary animal welfare concerns in relation to slaughter practices* [Factsheet]. WP1, DIALREL project. Retrieved from <https://www.dialrel.net/dialrel/images/factsheet-veterinary-concerns.pdf>

Specific critical points of slaughter without stunning according to WOAH TAHC

Bleeding

Bleeding without prior *stunning* causes animal suffering because the incision to sever blood vessels results in substantial tissue damage in areas well supplied with nociceptors. The activation of these nociceptors causes the animal to experience *pain*. Loss of consciousness due to bleeding is not immediate and there is a period during which the animals experience fear, *pain* and *distress*. This period will be reduced by applying *stunning* immediately after neck cutting.



«Post cut stun», accepted by some religious communities (both muslim and jewish)

Specific critical points of slaughter without stunning according to WOAH TAHC

Bleeding

In cases of bleeding without *stunning* the animal-based and other measures that indicate loss of consciousness include all the following: absence of muscle tone; absence of corneal or palpebral reflex; absence of rhythmic breathing. Unconsciousness should be reassessed until death is confirmed. In addition, cessation of bleeding after a continuous and rapid blood flow can be used as an indicator of death.

Crucial is checking unconsciousness

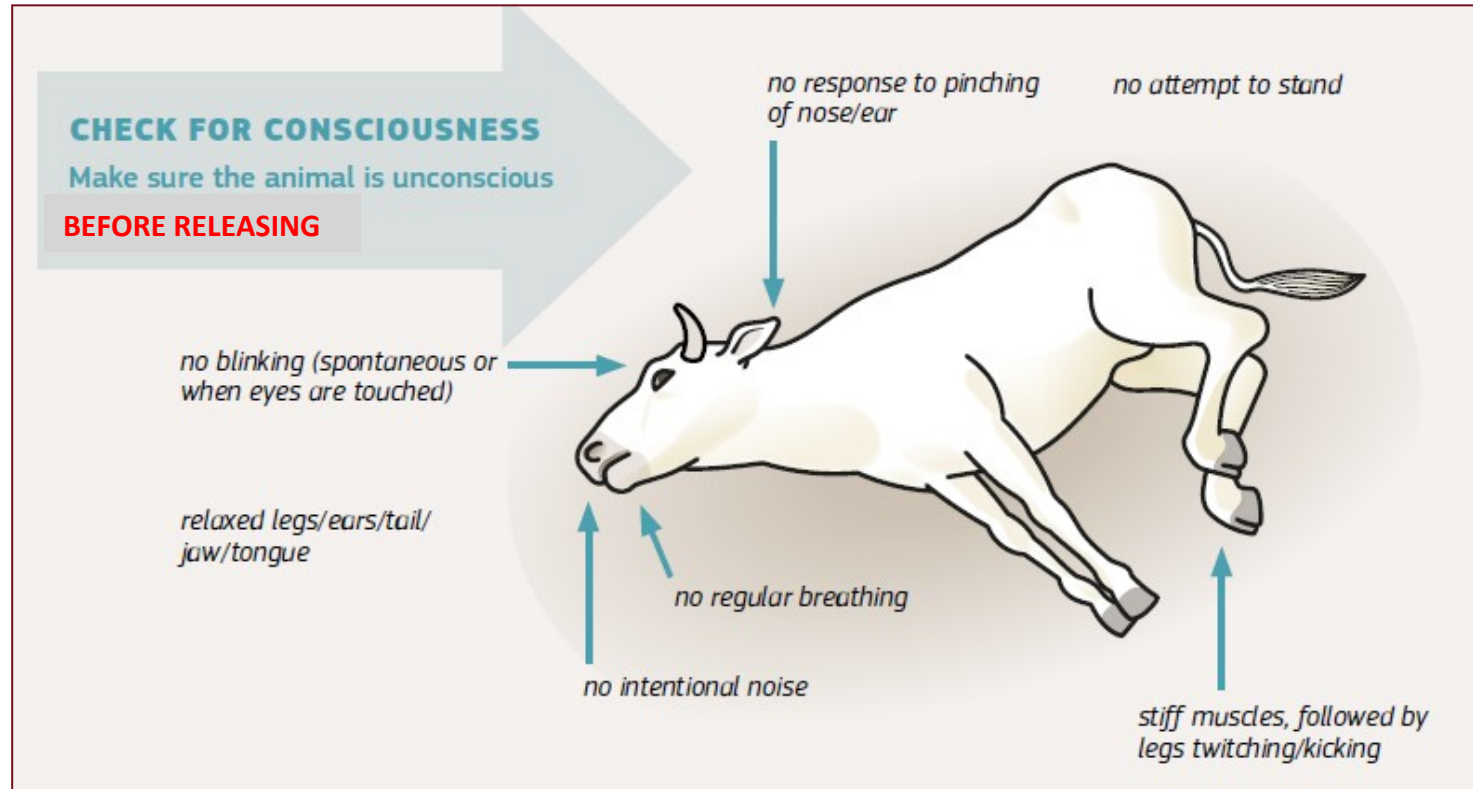
Slaughter without stunning:

- a) bleeding should be carried out by a single incision; any second intervention should be recorded and analysed to improve procedures;
- b) further processing may only be carried out when the death of the animal has been ascertained.

**Well sharpened knife, single cut, very
good training of operators**



UNCONSCIOUSNESS



Courtesy of Sara
Rota Nodari IZSLER



Main recommendations to no-stunning slaughter operators from the DIALREL project

EU Funded project carried out in 2006-2010

- **Containment Appropriateness:** Animals are contained only at the time of cut and bleeding that occurs without delay.
- **Containment Adequacy:** The type of containment is appropriate for the type of slaughtered animal, and the containment structure is properly built (adequate lighting, non-slippery floor, absence of sharp edges).
- **Care in Animal Introduction:** The animal is introduced into the containment device carefully to reduce stress and injuries.



Main recommendations to no-stunning slaughter operators from the DIALREL project

T E R A M O



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Reference Centre



World Organisation
for Animal Health
Enabling the OIE

- **Optimal Pressure:** Optimal containment pressure is applied.
- **Knife:** Sharp and adequate to the species
- **Severing of Major Vessels:** Both carotid arteries and both jugular veins are severed with a single cut.
- **Specific Training for Operators:** Operators performing the jugulation are properly trained in executing the cut.
- **Checking for Signs of Unconsciousness:** Signs of unconsciousness are checked at least twice: for cattle, between 30 and 40 seconds after the cut; for sheep, between 15 and 25 seconds after the cut.
- **Backup stunning** in case of prolonged consciousness

ThalaKos: Multidisciplinary Study on Ritual Slaughter

- **Food SafeTy, Animal Welfare, and Socio-Cultural Aspects in the Production and Consumption of HALal and KOSher Meat (IZSAM 01/20 RC). Acronym “THalaKos”**
- **Funded by Italian Ministry of Health**, in collaboration with other Public Veterinary Institutes in Italy and the National Reference Centre for Animal Welfare (CRENBA-IZSLER)
- **Carried out from 2021 to 2024 in 3 different slaughterhouses in Italy**, doing both religious and conventional slaughtering in poultry, sheep and cattle



Ministero della Salute



The Thalakos Project: Key Questions

- What are the **critical points** for animal welfare during religious slaughter?
- How does slaughter-related stress impact the **microbiological quality of meat**?
- Are the **DIALREL** recommendations applied?
- What is the **approach of religious communities** towards this type of slaughter?

Thalakos: Results

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Animal welfare and microbiological meat safety at religious and conventional slaughtering: a comparative study

L. Iannetti¹, T. Bogdanova², S. Ruta Nodari³, S. Amici⁴, G. Finazzi⁵, G. Mammucari⁶, V. Di Marzio⁷, M. Ferraro⁸, G. Centonze⁹, L. Di Marcantonio¹⁰, G. Scattoloni¹¹, V.A. Acciani¹², M. Podalini Vulpiani¹³

¹ Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ² Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ³ Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ⁴ Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ⁵ Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ⁶ Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ⁷ Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ⁸ Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ⁹ Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ¹⁰ Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ¹¹ Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ¹² Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy; ¹³ Istituto Zooprofilattico Sperimentale del Lazio e della Toscana, Via Appia Nuova 1041, 00198 Roma, Italy

Introduction

Meat production in Islamic and Jewish communities, according to religious traditions, involves specific practices, including halal and kosher slaughter, which are based on animal welfare and food safety. In 2024, the meat production value was about 2,000 billion euros and is expected to rise to 4,000 by 2030 (World Wildlife Fund, 2024). Concerns arise about the separation of halal slaughter from animal welfare regulations in the EU and its impact on meat quality. Consumer expectations are also changing, with a growing interest in halal slaughter and its impact on meat quality. This study aims to compare the microbiological quality of meat from halal and kosher slaughter with conventional slaughter, focusing on the separation of halal slaughter from animal welfare regulations in the EU and its impact on meat quality.

Materials and methods

A total of 40 carcasses were collected for each animal species (sheep, cattle and broiler chicken) and slaughter type (halal/kosher/conventional) to evaluate the microbiological quality of the meat according to the standards set by Regulation (EC) No 1831/2003. Further sampling focused on detecting specific pathogens, including *Salmonella*, *Escherichia coli*, *Staphylococcus aureus*, *Listeria monocytogenes*, and *Yersinia enterocolitica*. The analysis was extended to include Campylobacter and *Shigella* spp. on the rectal strip, as suggested by EFSA guidelines (EFSA, 2014). Faecal and environmental samples were also collected from various sites of the slaughterhouse (meat cutting, evisceration, carcass processing). The meat samples for microbiological analysis were collected from the rectal strip, the carcass, the evisceration, and the meat cutting area. The meat samples for microbiological analysis were collected from the rectal strip, the carcass, the evisceration, and the meat cutting area. The meat samples for microbiological analysis were collected from the rectal strip, the carcass, the evisceration, and the meat cutting area.

Results

Antibiotic counts were variable, with meat slaughter carcasses less contaminated on average than conventional carcasses (103 vs 2,063 CFU/g). *Salmonella* was found in 3.4% vs 2.1% of samples, while *Escherichia coli* was found in 17.1% vs 10.5% of samples. In meat slaughter carcasses, the number of *Salmonella* and *Escherichia coli* was lower than in conventional carcasses (17.1% vs 10.5% of samples). In meat slaughter carcasses, the number of *Salmonella* and *Escherichia coli* was lower than in conventional carcasses (17.1% vs 10.5% of samples). In meat slaughter carcasses, the number of *Salmonella* and *Escherichia coli* was lower than in conventional carcasses (17.1% vs 10.5% of samples).

Discussion and Conclusions

Regarding the hygiene of carcasses obtained through different stunning methods, usually no significant differences in contamination levels (microbiological count and *Salmonella* and *Escherichia coli*) were found. Properly conducted religious slaughter, adhering to hygiene and animal welfare rules, seems not to significantly impact the microbiological quality of carcasses. The study confirmed that stunning does not affect dressing efficiency and, consequently, carcass microbiological contamination. However, in one case (*Salmonella* in sheep), conventional slaughter showed significantly higher contamination, possibly attributed to the slower processing speed, allowing bacterial growth and coating of meat slaughter carcasses. The higher contamination is particularly evident in cattle carcasses, which should be carefully considered both in halal and conventional slaughter. In conclusion, the study advocates for comprehensive regulation of halal slaughter and the development of best practice guides. Such measures would protect religious communities, non-religious consumers, and animal welfare.

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- Despite general compliance with DIALREL recommendations and well-trained operators, some **critical issues** were identified.
- No significant differences in meat contamination (Salmonella, Enterobacteriaceae, Total Cell Count)
- Lack of regular consciousness checks for animals post-slaughter.
- Frequent application of 2 neck cuts
- Time to loss of consciousness, based on ABMs, is particularly long in cattle (60-277 seconds).
- Post cut stun accepted in 1 slaughterhouse out of 2
- Published in two conference abstract books, publication of scientific journal will follow

Thumbnail of a scientific paper titled "Animal welfare and microbiological meat safety at religious and conventional slaughtering: a comparative study". The paper includes a table of results and a figure showing the separation of meat during religious slaughter.

Parameter	Religious Slaughter	Conventional Slaughter
Salmonella	3.4%	2.1%
Escherichia coli	17.1%	10.5%
Antibiotic counts	103 CFU/g	2,063 CFU/g

Figure 1: Separation of meat during religious slaughter. The figure shows a diagram of the slaughter process, highlighting the separation of meat from the carcass.

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The cardiovascular effects of shechita in cattle:
a systematic review shows the fallacies that vertebral artery
will preserve cerebral blood flow and false aneurysms occur
in severed carotid arteries

Simon W. Rabkin, MD*



AJVR



Rapid loss of consciousness in cattle following nonstun
slaughter: evidence from a systematic review

Jacobs R, Hascall-Luevano MD, PhD*, Hyman M, Schipper MD, PhD*, Joe M, Regenstein, PhD*,
Stuart D, Rosen, MA, MEd, Ari Zivotofsky, PhD*, Guy St-Jean, DVM, MEd, Simon Freilich, MEd*,
Thomas J, Morrison, DVM, DACVIM*, Simon W. Rabkin, MD*, Sheryl Haus, MD, MEd

Recent publications from US/Canada scientists on consciousness in shechita slaughtering (without stunning)

- All from the same **research group**, all in **2025-2026**
- *Following court-issues in Canada* in 2024 regarding no-stunning shechita slaughtering
- Their **common aim** appears to be to **support**, through literature reviews and a haemodynamic mathematical model, **the claim that loss of consciousness during shechita slaughter is “nearly immediate”**
- This is **not supported by experimental evidence** checking consciousness via EEG/ECOG (while there is a number of studies demonstrating long agony particularly in cattle)
- ***Most of these reviews do not approach the problem in an independent way***, and are mostly aimed to discard currently accepted literature and standards (including WOAHA)
- Latest review from the same study group aims to highlight animal welfare concerns of stunning

Recent publications from US/Canada scientists on consciousness in shechita non-stunning slaughtering

Take-home messages

- **AW concerns on stunning** should not be underestimated
- **New protocols** for consciousness assessment are necessary, possibly **further validation of ABMs via EEG** would also be opportune
- Independent **new literature reviews** are necessary also to highlight flaws of these studies
- **No-stunning slaughtering can be improved, but it is not an alternative to stunning**
- **New haemodynamic/EEG experimental studies** are needed to further demonstrate time to loss of consciousness in non-stunning slaughter and how to keep it as shorter as possible

JAVMA



The cardiovascular effects of shechita in cattle: a systematic review shows the fallacies that vertebral artery will preserve cerebral blood flow and false aneurysms occur in severed carotid arteries

Simon W. Rabkin, MD •

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Blood pressure responses to captive bolt and electrical stunning in sheep and cattle: A systematic review

Simon W. Rabkin, MD, FRCP, FESC, FACC •

Department of Medicine (Cardiology), University of British Columbia, Canada

AJVR



Rapid loss of consciousness in cattle following nonstun slaughter: evidence from a systematic review

Jacob R. Hascavolici, MD, PhD^{1,2*} • Hyman M. Schipper, MD, PhD³ • Joe M. Regenstein, PhD⁴ • Stuart D. Rosen, MA, MD⁵ • Ari Zivotofsky, PhD⁶ • Guy St-Jean, DMV, MS⁷ • Simon Freilich, MBBS⁸ • Thomas J. Morrison, DVM, DACVIM⁹ • Simon W. Rabkin, MD¹¹ • Sheryl Haut, MD, MS¹

AJVR



Impact of carotid artery sectioning on cerebral blood flow in bovines: a numerical hemodynamic study

Asher Ben-Chimol, MASc¹ • Thomas Parmentier, DMV, PhD, DACVIM² • Jacob Hascavolici, MD, PhD³ • David Vidal, PhD^{1*} •

European Partnership on Animal Health & Welfare

90 partners, >1000 researchers

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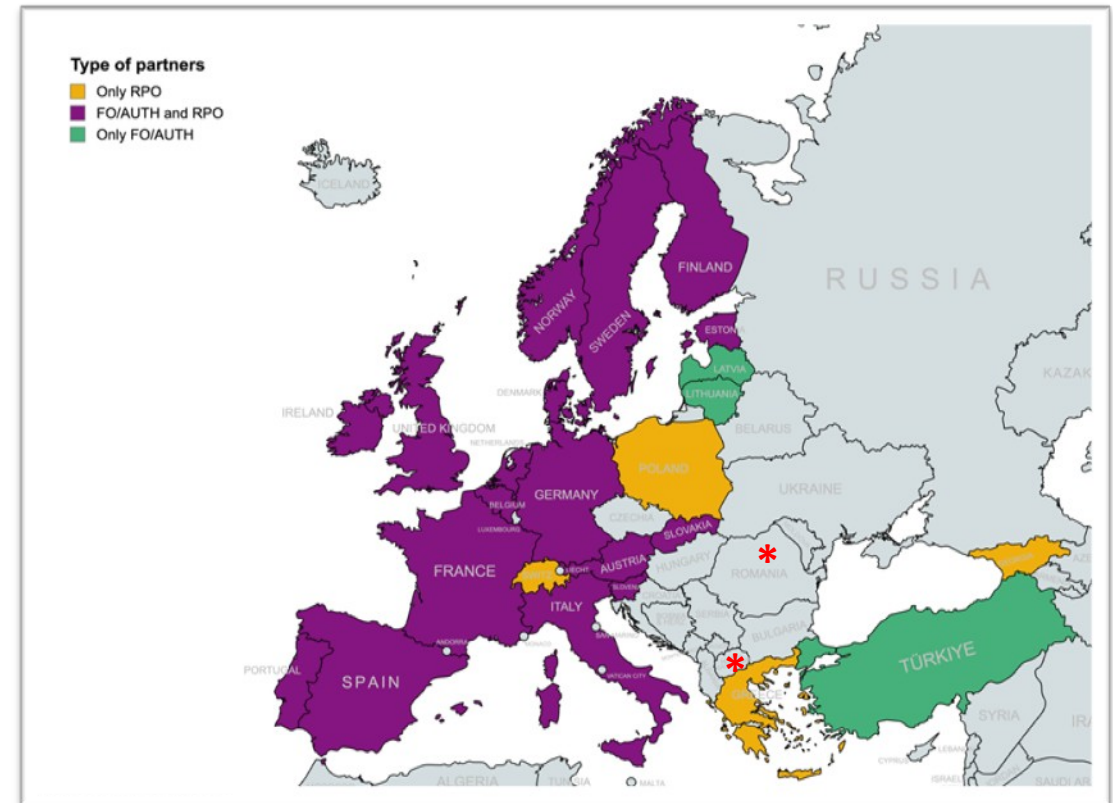
From 19 EU and 5 non-EU countries

Launched in January 2024, duration 7(+3) years

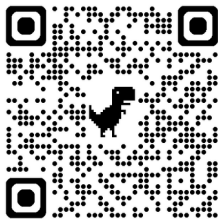
50% Co-funded Partnership

Expected total budget: **360 MEUR**

Coordinated by 
**GHENT
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*Romania, North Macedonia



SoA14 - Improved assessment of consciousness and death at slaughterhouse

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General objective:

Develop and provide indicators, technologies, procedures and/or protocols to increase the reliability of methods which assess (un)consciousness and death at slaughter or killing during other situations

Specific objectives

Objective 1: Overview of existing methods and protocols to assess (un)consciousness and death including gaps of knowledge for different species.

Objective 2: Develop objective assessment indicators, methods, tools and protocols to assess (un)consciousness and death at slaughter (1) and on farm or in transit (2)

Objective 3: The use of communication & dissemination to make protocols or assessment methods available to stakeholders

12 Research Performing
Organisations from 10
countries

Leader:



SoA14 - Improved assessment of consciousness and death at slaughterhouse



WOAH Collaborating Centre
for animal welfare



Where we are now (**group 3 «ruminants»**):

- **Systematic literature review** carried out and going to be published
- **3 improved protocols** drafted and now in the process of validation:
 - Consciousness of cattle in slaughter with stunning
 - Consciousness of small ruminants in slaughter with stunning
 - Consciousness of cattle and small ruminants in slaughter without stunning
- **Validation at slaughter** of indicators not yet validated
- Workshops with EU Stakeholders (competent authorities) to disseminate the new protocols



Conclusions

- **ABMs are crucial** to check (un)consciousness at slaughterhouse
- **Frequently** they are **not assessed** in practice
- **Improvements and new protocols/ABMs validations are needed**
- **Stunning** is the only way to reduce sufferance at slaughterhouse, but must be carried out correctly
- We have to deal with **slaughtering without stunning**, it does not seem a problem from the food safety point of view but it is for animal welfare
- It must **to be carried out correctly** in order to minimize sufferance
- **Post cut stun** could be a solution in certain contexts



Thank you!

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