

Good Practices in Reindeer Slaughtering

Slaughtering at a Slaughterhouse



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Karoliina Majuri • Kirsi Muuttoranta

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Slaughter of reindeer in Finland

The maximum permitted number of living reindeer in Finland is 203,700 living reindeer in the period of 2010–2020 (Ministry of Agriculture and Forestry 2010). The annual meat production volume is under 2 million kilos (Reindeer Herders' Association 2019). Consumers consider reindeer meat as an ethical and healthy choice and are willing to pay a good price for it. Thus, reindeer meat is regarded as a valuable product and strict quality requirements are imposed on meat production.

There are 19 reindeer slaughterhouses in the reindeer husbandry area of Finland (Finnish Food Authority 2019b). With the exception of one, all slaughterhouses are owned by reindeer owners or cooperatives. In Finland, there exists one large slaughterhouse company which buys live reindeer. Another large slaughterhouse, owned by a limited liability company, is under construction in autumn 2019.

This guide focuses on the operation and practices of slaughterhouses owned by reindeer owners. In the Porukkaoppi project, funded by the European Social Fund, all these reindeer slaughterhouses, except for one, were audited to collect good practices. These are presented in this guide. (Majuri and Muuttoranta 2019)

REINDEER WELFARE

The Animal Welfare Act (247/1996) regulates animal welfare requirements in Finland on a general level. According to the act, its objective is to “protect animals from distress, pain and suffering in the best possible way. The objective of this Act is also to promote the welfare and good treatment of animals.” Round-ups are a significant source of stress to reindeer. In Finland, a veterinarian is involved in round-ups to administer an antiparasitic treatment. In the same connection, the veterinarian monitors animal welfare and conducts the ante-mortem inspection at the round-up site (Ministry of Agriculture and Forestry 2014).

A comprehensive network of slaughterhouses reduces transport distances and costs. Animal welfare is ensured and meat quality remains good, if animals need not

be transported by vehicles. At four Finnish reindeer slaughterhouses, animals can be moved directly from the round-up site along fenced passageways to the slaughterhouse pens. The majority of slaughter reindeer are transported to slaughterhouses by lorries. (Majuri and Muuttoranta 2019).

In the case of small round-ups, reindeer are also transported by reindeer owners' own transport equipment. EU legislation (EC 2005) regulates the transport of live animals; a transporter authorisation is required for transport for commercial purposes exceeding 65 km. In the case of reindeer, granting the transporter authorisation is conditional on a completed animal transporter training to ensure the transporter's qualification to be in charge of animal transport and animal protection during it. The transporter authorisation is granted by the Regional State Administrative Agency, and it also approves all animal transport equipment used for transports exceeding 8 h.

Animal welfare is not only an asset in view of consumer choices, but also a significant factor in the quality of the final product. Stress and haematomas weaken the quality of the carcass and meat. These can be reduced by how the animals are handled.

JOURNEY OF REINDEER MEAT FROM THE SLAUGHTERHOUSE

In general, reindeer slaughterhouses do not buy reindeer, but sell the slaughtering service as a part of the cooperative activities. The cooperative sells the slaughtered carcasses to carcass buyers. It is also possible that the reindeer owners sell their own carcasses directly to their own customers (Majuri and Muuttoranta 2019). It is also possible to sell live reindeer to a slaughterhouse owned by a company. In this case, the cooperative will not benefit from the increase in value resulting from the slaughtering work.

Five Finnish reindeer slaughterhouses also have facilities for the further processing of carcasses. In these facilities, reindeer owners cut the carcasses into consumer packages and sell them to restaurants, shops or consumers. (Majuri and Muuttoranta 2019).

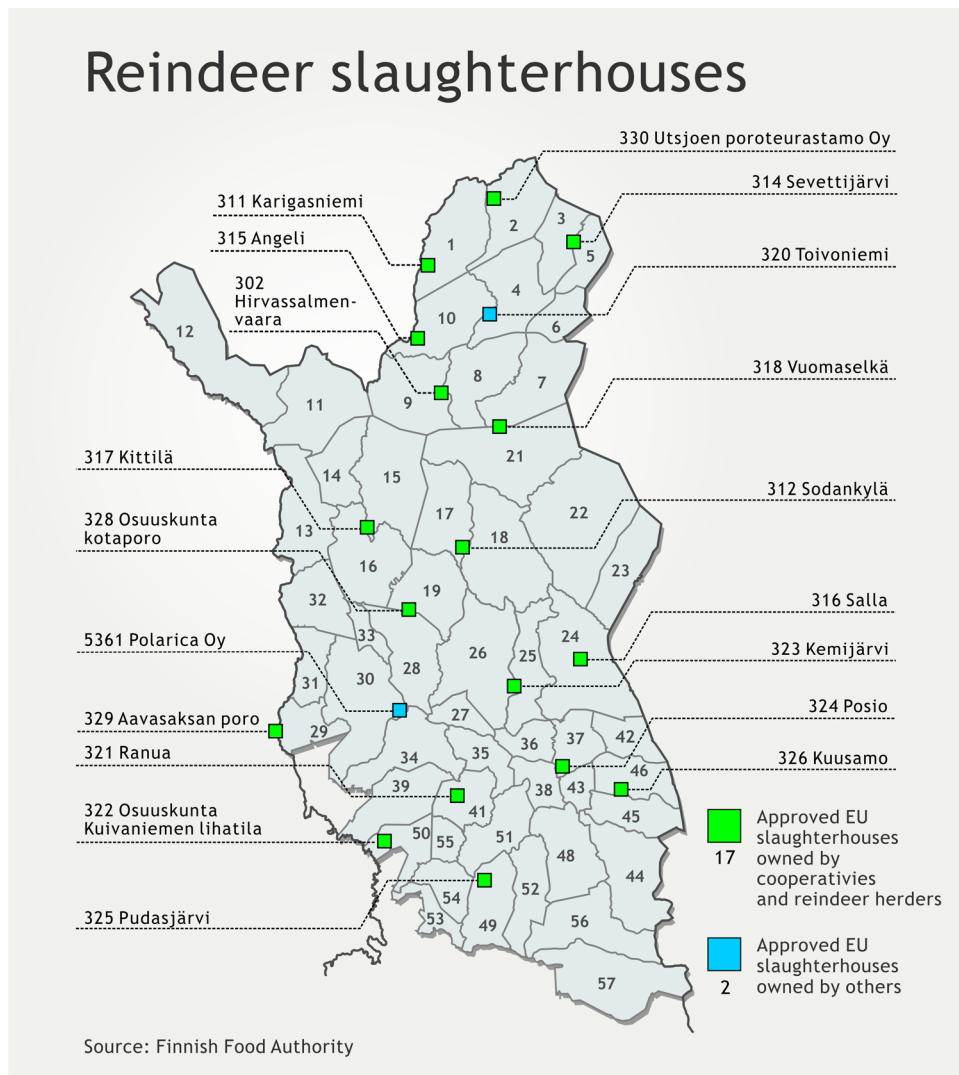
Finnish legislation sees reindeer meat production as a small-scale activity (Ministry of Agriculture and Forestry 2014). Due to the low production volumes, the direct sales of uninspected meat at the primary production site is a common policy and allowed reindeer husbandry. A consumer may buy meat directly from reindeer owners. (Finnish Food Authority 2019a). In the case of direct sales, reindeer need not be slaughtered at slaughterhouses (Finnish Food Authority 2019a). Approximately one third of Finnish slaughter reindeer are not slaughtered in slaughterhouses.

OTHER USES OF REINDEER SLAUGHTERHOUSES

At some reindeer slaughterhouses it is also possible to slaughter other animals. This is subject to a permit issued by the authorities. At one Finnish reindeer slaughterhouse, the ceiling height allows for the handling of cattle and horses. At all other slaughterhouses, the building structures restrict the handling of large animals and only allow for the handling of game and sheep in addition to reindeer. (Majuri and Muuttoranta

2019). Different animal species are not slaughtered at the same time, but they may be slaughtered during the same day. Care must be taken to ensure that the living animals are not on the same premises and that the slaughterhouse is carefully washed in between animal species.

Mostly bears are taken to game-processing slaughterhouses, although it is also possible to process elk. In Finland, 85 licences were granted for hunting bear in the reindeer husbandry area in 2019 (Ministry of Agriculture and Forestry 2019). Bear meat is valuable, although meat sales require a meat inspection and, among other things, *Trichinella* testing. There are good cold rooms for storing meat at slaughterhouses (Majuri and Muuttoranta 2019).



Picture 1. Reindeer slaughterhouses in Finland

Slaughterhouses are used only a few months a year. Extending their use to other animal species reduces the proportion of fixed costs in reindeer slaughtering. For example, in sheep slaughtering, profitability requires sufficient volumes due to the processing of by-products, which requires more work compared to reindeer by-products.

Reindeer slaughterers produce high-quality meat as a raw material for their own products to be sold to the customers. Producing raw material for yourself motivates to keep high-quality standards. Local production is of interest to the consumer and keeps the price of reindeer meat high. Through competence development, slaughterers know what to do and they do it right!

SOURCES:

Animal Welfare Act (247/1996)

Majuri, K. and Muuttoranta, K. 2019 (ed.). Näkökulmia poroteurastuksen kehittämiseen. Lapland University of Applied Sciences publications, 2019. (In press)

Ministry of Agriculture and Forestry 2010. Ministry of Agriculture and Forestry Decree 450/2010 (in Finnish) on reindeer marking districts and maximum permitted numbers of reindeer

Ministry of Agriculture and Forestry 2014. Ministry of Agriculture and Forestry Decree 590/2014 (in Finnish) on the meat inspection.

Ministry of Agriculture and Forestry 2019. Ministry of Agriculture and Forestry Decree 860/2019 (in Finnish) on bear hunting allowed with a special licence and regional quota in hunting year 2019–2020.

EC 2005. Council Regulation (EC) No 1/2005 on the protection of animals during transport and related operations and amending Directives 64/432/EEC and 93/119/EC and Regulation (EC) No 1255/97

Reindeer Herders' Association 2019. Porotietoa. Tilastoja. At <https://paliskunnat.fi/py/materiaalit/tilastot/poronomistajat/>. Retrieved on 1 August 2019.

Finnish Food Authority 2019a. Poronlihan suoramyntitoiminta. <https://www.ruokavirasto.fi/yriytykset/elintarvikeala/valmistus/elintarvikeryhmat/liha-ja-lihavalmistet/poronlihan-suoramynti/poronlihan-suoramyntitoiminta/> Retrieved on 27 July 2019.

Finnish Food Authority 2019b. Yriytykset. Elintarvikeala. Teurastus. Teurastamot. At <https://www.ruokavirasto.fi/yriytykset/elintarvikeala/teurastus/teurastamot/>. Retrieved on 27 July 2019.

INTRODUCTION

The guide has been written by Karoliina Majuri and Kirsi Muuttoranta of Lapland University of Applied Sciences.

The writing work has been supervised by Sauli Laaksonen. Matti Särkelä and Kari Henttunen of the Reindeer Herders' Association and Leena Magga, Outi Jääskö, Janne Näkkäläjärvi and Nilla Angeli of the Sami Education Institute have commented the text. Provincial veterinary officers Risto M. Ruuska and Ulla Rikula of the Regional State Administrative Agency for Lapland and the members of the steering group, reindeer herders Janne Mustonen and Tapio Saukko, have also given valuable input to the text.

We wish to express heartfelt thanks to all reindeer slaughterers for presenting good practices.



Picture 2. Reindeer carcasses

Reindeer slaughterer – clean quality

According to the Animal Welfare Decree, “professional slaughter may be performed only by an experienced or trained person who is at least 18 years of age”. What other requirements are set for personnel working at reindeer slaughterhouses?

1. COMPETENCE ACCORDING TO THE REGULATION ON THE PROTECTION OF ANIMALS AT THE TIME OF KILLING

According to the regulation, personnel carrying out certain slaughter operations shall have a certificate of competence demonstrating their ability to carry them out in accordance with the rules laid down in the regulation.

At reindeer slaughterhouses, the certificate of competence is required of personnel who:

- transfer reindeer to stunning
- hold on to reindeer during stunning
- stun
- hang or lift stunned reindeer
- bleed blood
- slaughter animals using particular methods of slaughter prescribed by religious rites

Acquiring competence to be eligible for the certificate of competence and demonstrating competence needed in slaughtering reindeer takes place via the Sami Education Institute. The certificates of competence are issued by the Regional State Administrative Agency. The certificates of competence are valid in all EU countries regardless of the country issuing them.

2. HYGIENE PASSPORT

According to the Food Act, persons working in food premises for a total of at least three months and who handle unpackaged, perishable food shall have sufficient competence in food hygiene. At a slaughterhouse, this pertains to skinning and the following carcass handling and head detaching including tongue handling. As proof of food hygiene proficiency, the workers must have a proficiency certificate, i.e. so-called Hygiene Passport.

Those having received it are considered to master the basic information in food hygiene. The three-month time limit specified in the act for the acquisition of a Hygiene Passport does not in practice bring about any exemptions to reindeer slaughterhouse workers:

even though the working days of one slaughtering season would not exceed three months, the time limit fills up when working regularly at the slaughterhouse during the slaughtering seasons.

3. HEALTH ASSESSMENT TO PREVENT SALMONELLA

A health assessment is required of persons handling unpackaged, perishable food in order to prevent the spreading of salmonella, if they work at the location for over a month. At a slaughterhouse, this refers to skinning and the following carcass handling and handling of other carcass parts intended for use as food. Consequently, a health assessment is required also of those detaching heads, if they handle tongues. The specified time limit of one month for acquiring proof of health does not in practice bring about any exemptions to reindeer slaughterhouse workers: even though the working days of one slaughtering season would not exceed a month, the time limit fills up when working regularly at the slaughterhouse during the slaughtering seasons.

Proof of health refers to either a negative salmonella test result or an interview with a doctor or nurse, which may take place over the phone if necessary. Proof of health is a written free-form certificate provided to the worker that needs to be submitted to the supervisor of the slaughterhouse. In the food industry, employers often require annual salmonella testing via the occupational health care service they pay for, even though the Communicable Diseases Act does not require it.

SOURCES:

Animal Welfare Decree 396/1996, Food Act 13 January 2006/23

Communicable Diseases Act 1227/2016, Section 56 Health assessment for employment regarding salmonella infection

National Institute for Health and Welfare (THL) 2019, Infectious Diseases, Procedure for preventing salmonella infections (in Finnish) at <https://thl.fi/fi/web/infektiotaudit/taudit-ja-mikrobit/bakteeritaudit/salmonella/toimenpideohje-salmonellatartuntojen-ehkaisuksi>

Finnish Food Authority, Handling unpackaged, perishable food in food premises, Is the Hygiene Passport, sufficient protective equipment or health assessment required of the worker (in Finnish), 13 March 2019, at https://www.ruokavirasto.fi/globalassets/yriytykset/elintarvikeala/elintarvikealan-yhteiset-vaatimukset/pakkaamattoman-helposti-pilaantuvan-elintarvikkeen-kasittely/pakkaamattoman_helposti_pilaantuvan_elintarvikkeen_kasittely-taulukko-13.3.2019.pdf

Council Regulation No 1099/2009 on the protection of animals at the time of killing

Hygiene

PLANT HYGIENE

No unauthorised persons should be given access to the slaughter hall. It is reserved to slaughterers alone whose competence, protective clothing and salmonella supervision are under control. Condition and order of the facilities, equipment and tools must be ensured. Their cleanliness must be verified before commencing work.

The facilities, equipment and tools of the slaughterhouse are carefully cleaned once slaughtering ends and disinfected as necessary. Cleaning must not cause harm to food. All surfaces and tools coming into contact with bare carcasses or organs must be kept clean also during slaughtering.

Tools, equipment and containers coming into contact with skinned carcasses and organs must not be used for any other purpose. Containers and tools meant for handling food must be clearly distinguishable from those used for other purposes. A good practice is to adopt a uniform colour-coded method between slaughterhouses to separate containers and knives intended for handling organs and by-products. This ensures uniform operating methods between authorities, trainees and workers working at several slaughterhouses.

The white containers reserved for food use are not used for any other purpose at the slaughterhouse. By-products, meat hooks, etc. are put into



Picture 3. Meat hooks must be stored so that the hook's section touching the overhead rail does not contaminate the hook section touching the carcass.



Picture 4. Carcasses are transferred from the meat hook with the help of a dedicated hook-ended tool. The hook intended for transferring carcasses is a more hygienic choice than cords for changing overhead rail lines. The hook for transferring carcasses can be thoroughly cleaned, hygiene of cords hanging at the rail junctions is most often inadequate and impossible to verify. Photograph by Sauli Laaksonen.

containers of a different colour. Different-coloured knives are reserved for handling by-products.

Food containers must not touch the floor, unless they are meant to be transported on the floor. Transport trolleys must be used underneath the white containers that are meant for carcass parts and organs. The disposable plastic bag used to protect the container makes it easier to wash the containers.

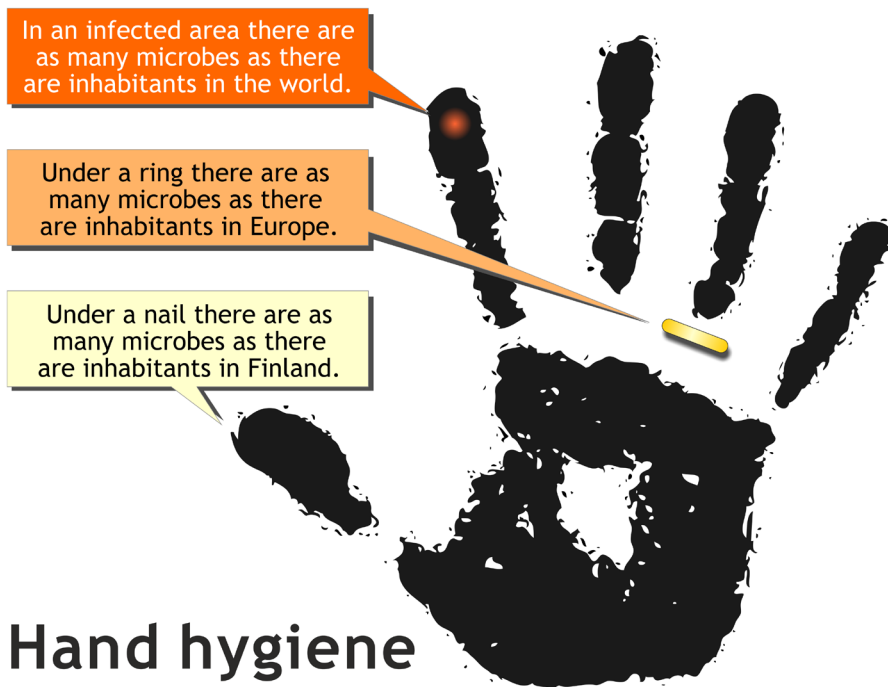
All waste, such as by-products, i.e. heads, limbs, etc., must be removed from the slaughter hall as soon as possible in order to avoid their accumulation.

PERSONAL HYGIENE

A worker cannot work at the slaughterhouse if they have infectious diseases, infected wounds, inflammation of the skin, skin lesions or symptoms of stomach disease, such as vomiting or diarrhoea. Clean clothing and boots appropriate for the work must be used at the slaughterhouse. The hands, tools and other equipment must be cleaned regularly. The hands and tools are washed with warm water after each working phase. The tools are disinfected in a sterilizer with a water temperature of at least 82 °C. If there is need to put down tools, they must be placed in the sterilizer. It is not allowed to use a knife sheath.

The slaughterhouse offers its workers appropriate protective clothing, hats and boots. The slaughterhouse also ensures their cleaning and maintenance. Often, slaughterhouses make use of laundry services or industrial washing machines. Porous materials (fabric) are protected by means of washable protective equipment, such as protective sleeves to be worn on top of long sleeves. Working clothes are taken off when taking a break.

According to good practices, equipment used in slaughtering must be kept at the slaughterhouse due to hygiene reasons. When work clothes are taken elsewhere, the risk of them coming into contact with, for example, pet hair increases during both



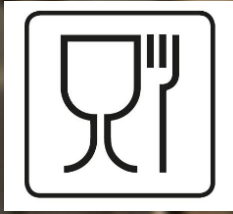
Picture 5. Hand hygiene must be observed, maintained and improved. Hand hygiene must focus on sufficient washing. Special attention must be paid to cleaning under the nails.

storage and transport. The slaughter hall working clothes are not to be worn when exiting the production facilities. Light-coloured working clothes enable easy spotting of dirt. A good practice is to separate workers of the dirty and clean side with the help of the colour of their protective clothing, for example, boots and hard hat in different colours. It is not allowed to move from the dirty side of the slaughter line to the clean side without a change of clothes and cleaning the hands and boots.

It must be possible to clean the gloves worn at the slaughter line during working. Steel-mesh and cut-resistant gloves must be protected with washable gloves. When working in the slaughter hall, all jewellery, such as rings and earrings, watches, piercings and sculptured nails, must be removed or covered with the help of protective clothing. Wounds must be protected, for example, with an adhesive bandage and protective glove. Hair must be covered.

BASIC HYGIENE OF A SLAUGHTERER

- no rings or other jewellery, piercings, watches, nail varnish, sculptured nails or adhesive bandages – or they must be covered with protective clothing
- skin on the hands must be healthy with no festering or infected wounds
- small wounds are protected with adhesive bandages or a gauze dressing and covered with a food-safe protective glove
- meticulous washing of the hands and arms with liquid soap when coming to work, after breaks and going to the toilet, after blowing one's nose and sneezing and after getting dirty
- hairnets in use
- touching hair and face, coughing, sneezing and blowing one's nose are to be avoided
- mobile phones do not belong to food working areas
- working clothes must cover personal clothes in their entirety and they as well as boots, hats and hard hats must be clean and only used at the slaughterhouse
- working clothes cannot be worn when going on a break or outside



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Picture 6. The use of disposable gloves in slaughtering is recommended in order to preserve food hygiene. Gloves are mandatory if rings, sculptured nails or nail varnish is used or if there are wounds on the hands. The gloves must be food-grade gloves, i.e. their package has the wine glass/fork symbol. The use of coloured rubber gloves helps in detecting missing pieces of glove due to a possible cut. Damaged gloves must be replaced with new ones.

SOURCES:

Regulation No 852/2004 of the European Parliament and of the Council, Annex 2, Chapters 5 and 7

Ministry of Agriculture and Forestry Decree on food hygiene at approved establishments 795/2014

Food Act 2006/23

Finnish Food Authority 2019. Personal hygiene (in Finnish) at <https://www.ruoka-virasto.fi/yritykset/elintarvikeala/elintarvikealan-yhteiset-vaatimukset/elintarvike-hygienia/henkilokohtainen-hygienia/>

SELF-SUPERVISION PLAN

Self-supervision is a support system required by food legislation for the implementation of slaughterhouse safety and food hygiene requirements. The self-supervision plan is a written account of the implementation of self-supervision. It includes a description of the slaughterhouse and its operations, hygienic operations, risk management and staff operations. Bookkeeping related to self-supervision includes records on the verification of its implementation, for example, measurement results on temperature monitoring, assessments related to salmonella monitoring, research results on the quality of water and meat, etc. The self-supervision plan must be kept up to date and reviewed annually. Each slaughterhouse worker must be familiarised with the self-supervision plan.

Meat inspection

The meat inspection includes the verification of the documents, inspection of live reindeer, i.e. ante mortem, and inspection of the carcasses and organs, i.e. post mortem. All animals brought to a slaughterhouse must undergo the ante-mortem inspection, (Ministry of Agriculture and Forestry Decree 795/2014, Annex 2, Chapter 1.5). According to the decree, animals brought to the slaughterhouse or parts thereof cannot be removed from the slaughter process without agreeing on the procedure with the veterinary inspector.

Information regarding the food chain that promotes food safety must be delivered to the slaughterhouse with the reindeer, i.e. the so-called slaughter batch-specific chain-information form. It is a good practice to place, for example, a letterbox outside the slaughterhouse for the storage of documents. This reduces the number of people visiting the slaughterhouse and the number of key holders remains under control. At reindeer slaughterhouses meat inspection is the responsibility of the Regional State Administrative Agency for Lapland. The Regional State Administrative Agency for Lapland appoints veterinary inspectors for reindeer slaughterhouses.

ANTE-MORTEM INSPECTION

The ante-mortem inspection makes sure that the animals to be slaughtered are fit for human consumption. The inspection may involve the specification of needed risk-management measures (e.g. slaughtering order). In addition, the implementation of animal welfare is part of the inspection.

The ante-mortem inspection at reindeer slaughterhouses is carried out by the veterinary inspector. In certain cases, reindeer may undergo the ante-mortem inspection at the reindeer round-up site or someplace else.

The date of reindeer slaughtering must be indicated to the veterinary inspector at least one day before the slaughtering.

The ante-mortem inspection must be carried out within 24 h from the arrival of the animals to the slaughterhouse and under 24 h before the slaughtering. An ante-mortem inspection performed at the round-up corral is valid at maximum three days.

“A slaughterhouse operator shall separate animals suspected being ill or hurt from the other animals and report them to the veterinary inspector before the performance of the ante-mortem inspection” (Ministry of Agriculture and Forestry Decree on food hygiene at approved establishments 795/2014, Annex 2, Chapter 1.5.)

“In connection with the ante-mortem inspection, the animals, pens or transport batch shall be marked so that it is possible to establish which animals have been approved for slaughtering or the operator shall have in place a system approved at the slaughterhouse by the veterinary inspector and at the holding site by the veterinary inspector performing the ante-mortem inspection.” (Ministry of Agriculture and Forestry Decree on Meat Inspections 590/2014, Section 7)

POST-MORTEM INSPECTION

Sufficient space, light and the possibility to wash the hands and disinfect the tools must be made available for the post-mortem meat inspection. In order to be able to assess symmetry, the carcasses must hang freely. Animal parts needed in the meat inspection must be kept separately so that their shared origin can be ensured. Ministry of Agriculture and Forestry Decree on food hygiene at approved establishments 795/2014, Annex 2, Chapter 1.4.)

SOURCES:

REGULATION (EC) No 854/2004 laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption, Chapter 7, Farmed Game A.3

Regulation (EC) No 853/2004 of the European Parliament laying down specific hygiene rules for food of animal origin, Annex 2, Section 3

Finnish Food Safety Authority's (Evira) guideline 16028/1. Eläimen elävänä tarkastaminen (ante mortem -tarkastus) osana lihantarkastusta (inspecting a live animal (ante-mortem inspection) as part of the meat inspection).

Ministry of Agriculture and Forestry Decree on food hygiene at approved establishments 795/2014, Annex 2, Chapter 1.5

Ministry of Agriculture and Forestry Decree on meat inspection 590/2014

Handling of live animals and slaughterhouse outdoor areas

Transfer to the round-up corral, separation and transport to the slaughterhouse cause stress to reindeer. Stress and bruises (haematomas) weaken meat quality. Appropriate handling of animals before slaughtering is one of the cornerstones of high-quality operations. Only healthy reindeer are delivered to the slaughterhouse. Transporting sick reindeer to the slaughterhouse is only allowed with a permit from a veterinarian. Injured reindeer are slaughtered first, followed by calves and fully-grown reindeer come last.

The animals must be provided with a calm setting. A fence outlining the slaughterhouse area and a locked gate prevent outsiders, dogs, foxes, etc. from entering the slaughterhouse area. Sufficient rest and food at the holding pens help the animals to recover. It is recommended to keep calves and fully-grown reindeer in separate pens.

A familiar female among the calves may calm them down. Animals coming from different separation sites are to be placed in different pens in order to avoid excessive bruises and dominance fights between unfamiliar reindeer.

It is recommended to mark calves without an earmark with a metal slaughter tag instead of cutting earmarks. Especially in sub-zero temperatures, cutting ears is not recommended. Additional marking methods include paint intended for animal marking or a plastic tag, if there is doubt about the metal tag's adherence to the ear. Also the collar used in calf marking may be left on the calf for it to be removed only at the slaughterhouse.

It is recommended to feed the animals upon their arrival to the slaughterhouse which allows them to calm down for eating and ruminating. Lichen, silage or dry hay do not fill up the rumen too much. According to the Animal Welfare Act, an animal shall be fed, if it has to wait for slaughter for over 12 hours. Water (or clean snow) must be available at all times. A thirsty reindeer may be up to one kilogramme lighter in terms of slaughter weight and its hide will be difficult to detach. Heated drinking cups are the best solution for giving water to the animals. The slaughterhouse pens must be safe for reindeer. They cannot have, for example, any nails sticking out or broken boards. There must be enough space for the animals, at least 1 m²/calf and 2 m²/fully-

grown reindeer. The maximum numbers of animals must be clearly marked on the pens.

Dividing the holding area to smaller sections and numbering them is a good practice, which makes it easier to unload the animals from vehicles and their inspection when alive.

The base of the holding pen impacts the cleanliness of the animals. Bark mulch, wood chips or macadam are the best base materials. The pen base must be cleaned or the surface material replaced annually. Cleaning is easier if the pen can be accessed with a tractor or skid-steer loader.

A noticeably ill, hurt or injured animal and suckling calves are to be slaughtered straight away, however, no later than within two hours following their arrival to the slaughterhouse or slaughter site. Before slaughtering, the above-mentioned animals must be kept separate from the other animals. (Animal Welfare Decree 1996/396)

"Animals which are unable to walk shall not be dragged to the place of slaughter, but shall be killed where they lie" (Regulation (EC) No 1099/2009 on the protection of animals at the time of killing, Annex 3, Article 1.11)



Picture 7. An example from the Vuomaselkä reindeer slaughterhouse on how to pen-specifically mark the maximum number of reindeer and what constitutes a safe gate.



Picture 8. Wood chips is an ideal base material for outdoor pens. It is water-permeable and agreeable to reindeer. A heated water cup is the best solution to guarantee sufficient intake of water. Photograph from the Pudasjärvi slaughterhouse.



Picture 9. It is natural for reindeer to walk on an upward slope. In a narrow race it is difficult for reindeer to turn in the return direction.

Stunning

Stunning and the preceding procedures are critical points in view of animal welfare and meat quality. Therefore, particular attention must be paid to them. The success of stunning is the keystone of ethical meat production. Stunning must take place without stress, bruises and haematomas.

Successful stunning guarantees a quick and painless loss of consciousness, which must continue until the animal's death, i.e. end of bleeding. Stunning has an impact on meat quality, because solidly unconscious reindeer bleed out the best. Inappropriate animal handling before stunning and unsuccessful stunning are great causes of stress to reindeer. Due to stress, blood will remain in the meat. Too strong or misplaced stunning may cause a reindeer to inhale vomit, which gives harmful bacteria an access to the clean side with the organ bundle.

TRANSFER TO STUNNING

Moving reindeer in small groups makes the work of the handler easier. Fellow reindeer also provide a sense of safety to reindeer. Reindeer are to be moved to the stunning site only when their slaughtering can begin without delay. Animals may not be kept waiting in the stunning premises (Animal Welfare Decree, Section 40). A moderate number of reindeer at a time are transferred to the waiting, i.e. capturing, pen in order to avoid bruises. The waiting, i.e. capturing, pen and the race leading there should be well lit and noiseless and their floor may not be slippery. Good conditions make it quicker and easier to handle animals. According to the Regulation on the protection of animals at the time of killing, the waiting pen shall have a level floor and solid sides and designed so that animals cannot be trapped or trampled.

STUN GUNS

The allowed methods for stunning reindeer are a penetrative captive bolt device, firearm with free projectile and electrical stunning. The stunning equipment must be reliable. (Animal Welfare Decree, Section 43).

Powder-actuated and pneumatic bolt pistols used at reindeer slaughterhouses must be regularly maintained. The stunning equipment must be disassembled and cleaned

after every slaughtering. Pneumatic pistols are more sensitive to issues and they contain advanced technology, so their operation must be carefully monitored. Back-up equipment must be immediately available at the slaughtering site (Regulation on the protection of animals at the time of killing, Article 9). The back-up equipment must be ready for use at the stunning booth and it must be used immediately, if the primary stun gun shows signs of malfunctioning.

HOLDING

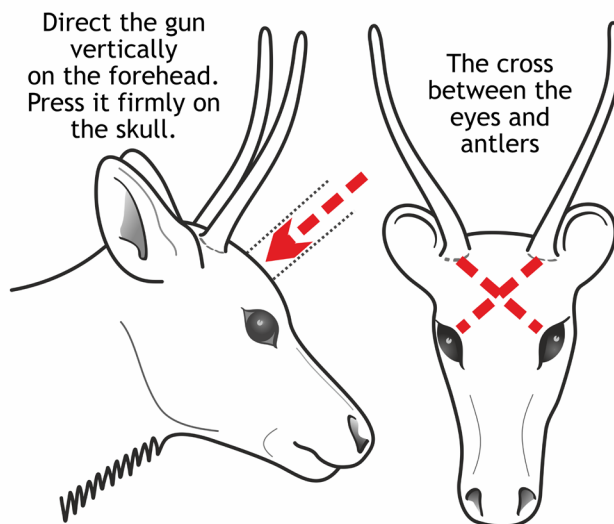
The animal to be stunned must be held to allow successful stunning (Animal Welfare Decree, Section 42). The stun gun is pressed firmly against the forehead of the animal so that the force of the gun is directed on the animal and it will not bounce the gun off the skull. It is a good practice to have at least two persons involved in stunning, one to stun and one to hold. In the case of large fully-grown reindeer, several persons may be needed to hold the animal.

ACTUAL STUNNING

Reindeer are stunned individually so that the others do not see the stunning. The company of follow reindeer, however, calms them, so in certain cases it may be considered justified to stun the last two reindeer waiting for stunning at the same time. Stunning more than two reindeer at a time is not accordant with the good slaughtering practice. There are risks of already stunned reindeer to be trampled (bruises on the carcass) and delayed bleeding. Sticking must be done within one minute of stunning! Dragging over thresholds, throwing, dropping and other rough handling of a stunned reindeer leaves marks on the carcass. It is a good practice to stun reindeer next to a lifting device. This reduces bruises and ensures quick start of bleeding.

It is not allowed to stick a conscious animal! The person performing the stunning (and sticking) must always make sure that the stunning of the animal has been successful. A correctly stunned animal is unconscious with no signs of consciousness.

The correct stunning point



Picture 10. The correct stunning point is at the cross between the eyes and antlers, and the gun is directed vertically on the forehead, pointing towards the jawline.

SIGNS OF SUCCESSFUL STUNNING:

- immediate collapsing
- the head, ears and tongue become flabby
- the eyes are lifeless and unresponsive to touch
- muscle spasms that can be manifested even as fierce movements of the limbs and carcass are not a sign of an unsuccessful stunning, if they stop within twenty seconds or so

THE ANIMAL MUST BE IMMEDIATELY STUNNED AGAIN TO A SLIGHTLY DIFFERENT POINT, IF IT SHOWS JUST ONE OF THE SIGNS OF UNSUCCESSFUL STUNNING:

- neck bending, head raising
- eye blinking, manifestation of the corneal reflex
- pain reactions
- rhythmic breathing movements (breaths at least three times regularly)

SOURCES

Regulation on the protection of animals at the time of killing, Annex 2, Layout, construction and equipment of slaughterhouses, Paragraph 2

Animal Welfare Act 247/1996

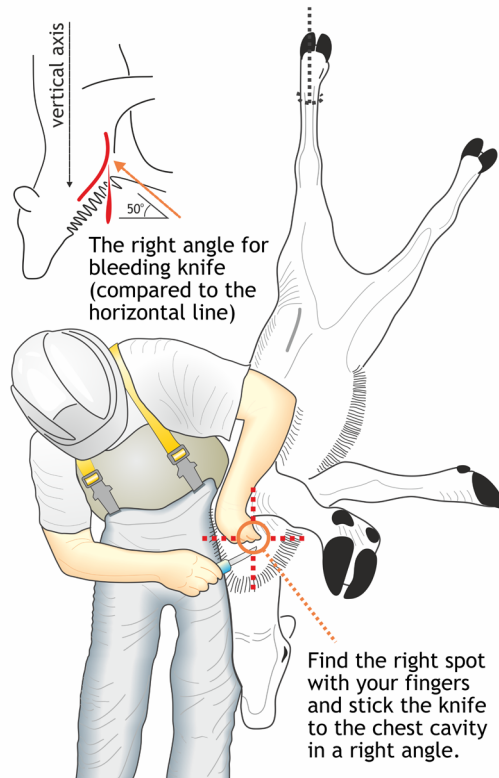
Animal Welfare Decree 1996/396

Sticking, i.e. bleeding

A reindeer does not die as the result of stunning, it dies due to blood loss resulting from bleeding. It is the easiest to start bleeding at approximately 15 seconds after stunning, i.e. at a point where the animal has stiffen immobile to the so-called sawhorse position. The law, however, allows sticking within 60 seconds of stunning so that the animal can be hung for sticking. The person in charge of sticking must make sure that the animal is solidly unconscious. If the animal is not completely stunned (or if slaughtering is continued straight after sticking when the animal is not yet dead), the animal gets stressed. As the result of such stress, the blood vessels will contract and bleeding will not take place in a satisfactory manner and blood will remain in the meat. The blood volume of a reindeer is 7% of its live weight, i.e. there is approx. 3.5 l of blood in a calf with a slaughter weight of 25 kg. The best way to get the blood out is to sever the large vessels close to the heart and the heart pumps the blood out. Chest sticking must be made parallel to the carcass in order to avoid shoulder sticking and severing of the oesophagus. After bleeding, the energy supply to the muscles turns anaerobic and the resulting lactic acid starts the decline in the pH value.

Reindeer are stuck while hanging. Sticking while lying down increases the risk of aspiration, i.e. inhaling rumen contents. Occupational safety and avoiding kicks need to be taken into consideration. Sufficient space at the sticking site makes working easier and safer. There is no need to skin the sticking point. Removing the skin of the sticking point increases the contamination risk of the carcass.

Correct performance of the bleeding



Picture 11. Correct performance of the chest sticking.



Picture 12. The bloodiness of the shanks allows checking the success of bleeding. Very bloody shanks and skirt are an indication that blood has remained in the meat. At the hide pulling site it is easy to see whether the hind shanks are bleeding. The bloodiness of the hind shanks and neck is evident still in the cold store. The above images show the difference between clean and bloody hind shanks.

Detaching the head, tongue and oesophagus

According to the Regulation on the protection of animals at the time of killing, the work phases can be started only when the animal has died. In practice this means that an animal whose body moves/trembles is given time to bleed out still and its processing is not started. It would be good to let blood bleed for five minutes before continuing with the slaughtering.

"Death is ensured by stating the missing of all life signs after bleeding."

The death of an animal, like unconsciousness, cannot be stated by watching just one factor. The following signs indicate to the death of the animal:

- The animal does not breath
- The heart does not beat
 - There is no pulse when trying to find it underneath the front shoulder
- Unchanged gaze, no eye reflexes
 - The eye does not react to touch at all
 - * No corneal reflex
 - * No eyelid reflex
 - No pupil reaction
 - * Pointing a bright light to the eye does not cause pupil contraction
- Gums are slowly turning pale/white
- Muscles may twitch slightly even though the animal is dead"

SOURCE

Finnish Centre for Animal Welfare 2013, Hyvä toimintatapa teurastuksessa – Nauta (good practices in slaughtering – Bovine)

DETACHING THE HEAD

In the head detaching technique, it is important not to make the cut against the hair, which causes the hair to be cut and, thus, contaminate the carcass. Therefore, the head detaching is started from the throat directing the incisions towards the neck. This way, the neck end stays clean. Contamination also takes place if the head needs to be rotated during detaching.

The head is detached by cutting tissue between the larynx and scull and the first cervical vertebra (atlas vertebra) so that the ears remain in the hide.

Heads are to be transferred directly outside via a hatch or gathered neatly in one place to wait for transfer outside. The handling of heads must not cause a risk of contamination, such as splashes resulting from throwing them.

DETACHING THE TONGUE

The tongue can be detached before removing the head or afterwards.

Skinning the lower jaw and making an incision along the edge of the lower jawbone up to the jawline removes the tongue from the mouth and jaw tissue, after which the tongue is severed at its root in front of the hyoid bones. The tongue is washed under running water and hung on a dedicated tongue rack in the slaughtering order. Keeping the tongues in order enables their linking to the correct carcass. If the whole carcass is rejected also the tongue must be rejected. The tongue is hung from tissue at the tongue root. The hook must not penetrate the skin of the tongue to avoid bacteria access to the muscle. The tongue rack must be kept clean. When moving tongues to the cold store, it must be ensured that no unallowed crossing between the dirty and clean side takes place.

DETACHING AND TYING OF THE OESOPHAGUS

The oesophagus can be detached while the animal is hung or when it is already on the skinning cradle. Careful detaching and tying of the oesophagus are preconditions for keeping the carcass clean during evisceration. The oesophagus is revealed from behind the trachea and carefully detached by pushing the detaching tool from the reindeer's head end towards the tail. The oesophagus detaching tool is washed and sterilised in between every reindeer. The detaching tool is kept in the sterilizer. The oesophagus is tied into a knot or it can be stapled shut. A knot holds better when the muscular layer is detached from underneath it. When using staples, the cleanliness of the stapler must be ensured. The ends of the trachea and oesophagus are shortened to prevent them from contaminating the carcass during skinning.



Picture 13. Washed tongues are hung without penetrating the muscle and protective skin.

Hide cutting and skinning the chest end

The hide cutting is – together with the detaching of the digestive tract – one of the most critical phases in terms of ensuring the hygienic quality of reindeer meat. Most often, contaminations result from these two work phases. The outer surface of the skin and hands, tools and equipment having touched the outer surface of the skin must not touch the carcass. This prevents the transfer of faecal, soil and skin bacteria to the carcass. Even though the hide looks clean, its outer surface is still heavily contaminated.

The hands and knife are washed and the knife is switched in the sterilizer after each work phase. When the knife is not in use, it is kept in the sterilizer. The knife must never be placed on top of the carcass to avoid the transfer of the hide's contaminants to the knife.

In the process of hide cutting and skinning the chest end, the clean and sterile carcass is exposed to contaminants. Therefore, it is vital to make use of the 'clean and dirty hand technique' in the work phases. The so-called dirty hand touches the hair surface of the hide while the other hand stays clean the whole time. The hide hand must not touch the carcass.

LOWERING THE CARCASS ON THE SKINNING CRADLE

The carcass is carefully lowered on the skinning cradle. Dropping the carcass may cause haematomas or break cell membranes and weaken the carcass quality. In addition, there is a risk of splashing. The skinning cradle must be positioned to a sufficient distance from other carcasses to make sure that the carcass being lowered does not make contact with another carcass that has already been skinned in part.

HIDE CUTTING

The knife must always cut from inside to outside so that the contaminants of the skin and hair do not come in contact with the carcass. This technique also reduces cutting of hair and its access to the skinned surface.



Picture 14. Females with milk in the udder are cut so that the knife passes around the udder on both sides. The udder stays intact and no milk runs on the carcass. Milk is an ideal culture medium of bacteria.



Picture 15. Detaching leg skin from the cut front tibia may prevent, depending on the skinning cradle model, the leg from slipping off the clamp during hide pulling.



Picture 16. The hide is opened sufficiently to prevent the hair side from curling to touch the bare carcass and tissue does not remain attached to the hide during hide pulling. The hide is not detached from tissue by touching with the fists or hands.

Cutting begins by cutting the skin on the abdominal side along the middle line from the throat to the anus. The udder containing milk is left intact by cutting on both sides of the udder. The knife is switched to a clean one after making the first cut that penetrates the hide. This prevents the access of contaminants to underneath the hide, i.e. on the surface of the carcass. A straight opening cut on the front legs prevents hide breaking during hide pulling.

SKINNING

The chest end skinning and work phases not involving a knife are performed with clean hands. The hide is detached by pulling from the hide and avoiding all contact with the carcass. Dirty hoof bottoms must not contaminate the carcass already skinned at the chest end. When skinning the front legs, the hide comes off more easily when pressing against with the knife from the front shank towards the tail.

SOURCES

Regulation (EC) No 853/2004 of the European Parliament laying down specific hygiene rules for food of animal origin, Annex 3, Chapter 5.

Hide pulling

Hide pulling is a critical stage in view of hygienic quality, because the carcass is transferred from the dirty side to the clean side.

Most often, hide pulling is carried out with the help of a mechanical hide-pulling device. It is recommended for slaughterhouses to have a back-up device or a plan for acquiring a replacement device in case the machine breaks during slaughtering. The chains and control panel of the hide-pulling device must be kept clean. If necessary, the control panel can be protected with a disposable plastic bag, which can be replaced, or some other similar means of protection. The hide is detached without touching it by the hands. Staining of the carcass with blood is to be avoided. Cutting the hide off the neck with a knife reduces splashing of blood. The carcass and pulling outcome are monitored during hide pulling. If tissue from the carcass remains on the hide, the cutting technique needs to be revised. Tissue remaining on the hide may also result from poor quality cutting, in which case the hide pulling worker gives feedback to the cutting worker to correct the situation. During hide pulling, care must be taken to avoid possible dripping of blood or running of urine from a carcass being lifted up on top of carcasses waiting on skinning cradles. Mammary glands and male genitals are detached while the carcass hangs. This prevents the running of secretion on to the skinned carcass. The most opportune position for their removal is when the back legs are spread.

The tag that is removed from the ear is washed and sterilised before it is attached to the carcass. Water splashes must be avoided. The tag can be attached with fingers or pliers, which must be kept clean during the whole slaughtering process. If the hands are protected by means of taping or cut-resistant gloves, a food-grade rubber glove must be worn on top. The hide is removed from the slaughter hall by placing it in the hide hatch immediately after hide pulling. The hide must be handled so that no dirt or loose hair falls off of it.

Legs are placed neatly into containers or put outside of the slaughter line via hatches. The legs must not be thrown due to the risk of splashing.

In work phases, which involve the use of a knife, the knife must be switched in the sterilizer to a clean one in between every work phase. Hide pulling is the last work phase on the dirty side. The bare carcass is not touched by the hands, it is to be moved with the help of the carcass hook.



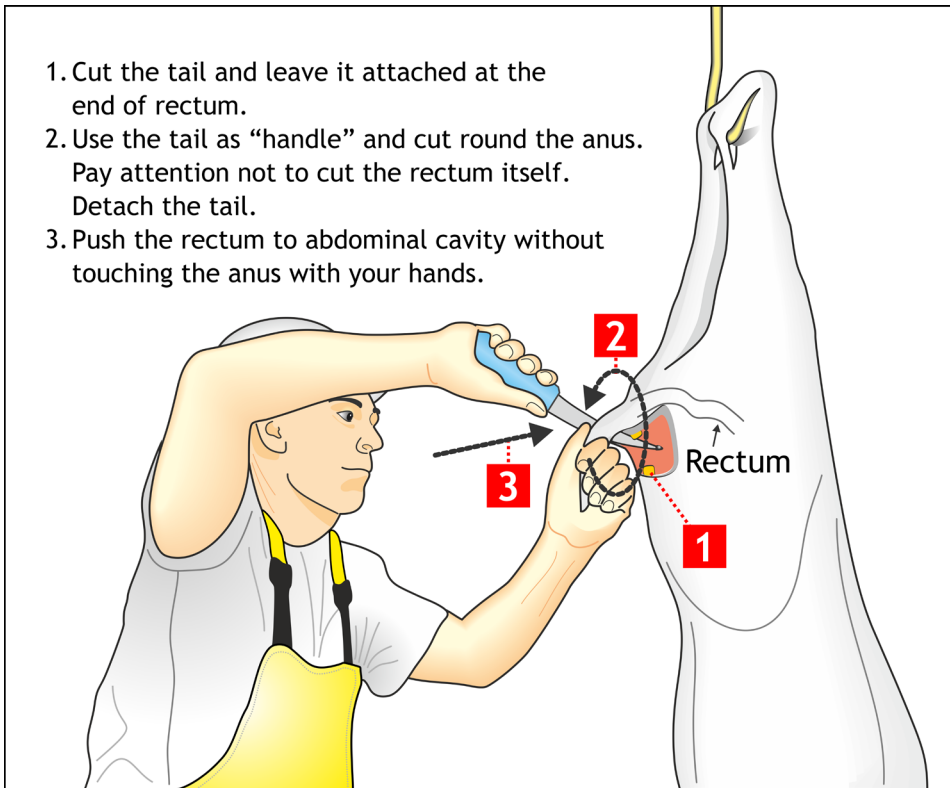
Picture 17. It is recommended that removals are not made on the dirty side, but the udder and genitals are the easiest to remove in connection with hide pulling. In that case, particular care must be paid to hygiene.

Detaching the digestive tract

The clean side of the slaughter line begins at the point where the hide has been detached from the carcass. Gutting is the first work phase on the clean side. The skinned carcass is exposed to contamination and splashes. In order to avoid contamination, the carcasses must not touch each other or any surfaces, such as walls, doors or the gut container. Touching the carcass by the hands, tools or clothes must be avoided. The knife is switched in the steriliser after each work phase. The hands and arms must be washed after each reindeer. Splashing of water on the carcasses must be prevented. The cleanliness of the gut container must be ensured during the whole slaughtering process.



Picture 18. The digestive tract is attached to the abdominal cavity. Photograph by Sauli Laaksonen.



Picture 19. The different work phases in detaching the rectum.

When detaching the rectum, the tail must be used as a handle to avoid touching the anus with the hands. After detaching, the rectum is pushed deep into the abdominal cavity. The knife used for detaching it is rinsed and placed in the sterilizer.

The contents of the rumen and intestines is the most microbial part of the animal. Puncturing the digestive tract must be avoided by all means, and not cuts are allowed to any of the other organs either, such as the uterus or urinary bladder. The rectum and urinary bladder are pulled away with particular care. The support membranes of the digestive tract are detached and the oesophagus is pulled through the diaphragm to the abdominal cavity side. The rumen and spleen are separated from each other. The digestive tract falls out due to its own weight. In order to prevent tears, it must be supported. Especially in the case of older animals there are often adhesions in between and the risk of tearing is great. The digestive tract must be inspected to detect any changes. If the organs in the abdominal cavity (excluding the liver, kidneys, udder and genitals) are inspected by a qualified slaughterer, according to new legislation that will take effect on 14 December 2019, only the intestinal bundles that show changes meaningful in terms of the meat inspection will be salvaged for the inspection to be conducted by the veterinarian.



Picture 20. The connection between the liver and small intestine.
Photograph by Sauli Laaksonen.

WHEN A MISHAP HAPPENS

If the rumen contents comes in contact with the carcass, the contaminated area is removed by cutting. The rumen contents is wiped off with paper tissue from the top of diaphragm meat before the organs are removed. This way it will not run down on to the sides and neck. The contaminated peritoneum is removed with a knife and by pulling it off. If necessary, the work clothes will be replaced and the work area (especially the edge of the gut container) rinsed.

Organ removal

OPENING THE CHEST

Opening the chest should be done on the clean side of the slaughterhouse. This minimises contaminants in the carcass. Tissue on top of the breast bone are cut with a clean knife all the way to the breast bone in order to avoid the formation of meat meal. The chest is split by sawing the breast bone up to the chest opening. Alternatively, the chest can be opened with a knife at the costal cartilage, i.e. at the connection point of the breast bone and ribs. The knife and saw must always be sterilised in between work phases.

DETACHING THE ORGANS

The diaphragm is cut off by following the chest contour, and the adhesions to the pericardium are severed. The kidneys and large blood vessels are detached. The organ bundle falls down almost on its own. The process is assisted by pulling. Chest spreaders may facilitate working and reduce arm contamination but they have to be sterilised in between each reindeer.

Touching the carcass and splashing of blood must be avoided at all times. The organs must not touch the floor. They must be either supported or a clean container must be placed underneath them.

ORGAN HANDLING

It must be possible to link the organs to the carcass from where they have been removed. The organs form an important part of the meat inspection, because they enable the detection of changes caused by illnesses and parasites. The organs must not be washed with water. Any contaminants on the organs are removed by cutting. Deviating or contaminated organs are hung separately while ensuring their traceability.



Picture 21. Detaching the diaphragm. Photograph by Sauli Laaksonen.



Picture 22. The heart is split in order to remove blood from the ventricles. The organs are hung freely from the aortic arch on a rack. The aorta is strong enough to support the heaviest of organs without any danger of the falling. Cutting the trachea helps with the meat inspection.



Picture 23. The traceability of the organs must be maintained, i.e. it must be possible to link them to the correct carcass up to the end of the meat inspection. Therefore, the organs are hung in the slaughtering order and marked, for example, at every ten bundles using, for instance, plastic labels in order to facilitate the finding of the correct carcass. No paper labels are attached to the organs or carcasses, which could introduce foreign substances to the carcass upon becoming wet.

Carcass finishing

Before transferring a carcass to the cold store, it must be thoroughly inspected from the inside and out. Bloody neck meat is removed from the carcass by cutting with a knife. Possibly remaining genitals and mammary glands or parts thereof are removed. Any loose hair is removed by picking. The final removal of loose hair takes place by burning when the carcass has cooled down. It is not allowed to remove any limbs or other parts before the meat inspection. However, all visible contaminants must be removed from the carcasses. Any possible contaminants on the carcass are removed by cutting with a knife. The carcass is not to be cleaned with water or wiped with paper tissue, cloth or any other porous material.

The carcass quality is monitored with regard to different slaughtering faults, such as haematomas, shoulder sticking, contamination, fillet cuts, etc.

Tools used in the carcass finishing must be clean and sterilised. The finishing must make use of the technique involving two knives. If there is a risk of, for example, the neck touching the floor, a clean meat container must be placed underneath the carcass.

CONTAMINANTS ON THE CARCASS

Contaminants on the carcass is a sign of unsuccessful slaughtering hygiene. The contaminant origin should be established and the situation in the slaughtering line corrected. Contaminants are not allowed even on the carcass parts that are not in general used as food, e.g., the throat hollow or ends of the hind shanks. Contaminants on the carcass always enable the spread of contamination to food in the cutting phase. Hand and tool hygiene, moving carcasses with the dedicated carcass hook, preventing carcass contact (with each other, surfaces, clothes and hands) and mastering the correct slaughtering techniques at every work phase are key in the prevention of contamination.

TYPICALLY CONTAMINATED CARCASS PARTS

Hind shanks. Contaminants on the hind shanks are prevented by the hand hygiene of the worker pulling the hide, clean carcass hooks and by not cutting the back legs until the hide pulling.

Tail surroundings and inside of the iliac bone. The hand and knife hygiene of the worker performing the gutting and the correct technique keep the tail surroundings and the inside of the iliac bone clean.

Throat hollow and neck. Getting hair in the throat hollow is prevented with the correct head detaching technique. Contaminated throat hollow is cleaned by removing it with a saw or cutter, not by washing with water.

Abdominal cavity edges. The arm and knife hygiene of the workers performing the gutting and organ removal and the correct technique keep the edges of the abdominal cavity clean.

Chest end. Hygiene of the workers cutting the hide and the skinning technique of the chest end that prevents hide curling and the hooves from coming into contact with the carcass keep the chest end clean. The chest opening saw must also be kept clean.

Front shanks and axillae. Hand hygiene and ensuring the cleanliness of a tall gut container keep the front legs clean.

The carcasses are to be touch as little as possible and they are preferably moved with the help of the carcass hooks. Moving is facilitated by well-sliding overhead carcass rails. Only food-grade lubricants are allowed. Clean carcasses and organs are transferred to the cold store. In the carcass store, the maximum temperature is +7 degrees, and in the organ store +3 degrees.

SOURCES

Regulation (EC) No 853/2004 of the European Council laying down specific hygiene rules for food of animal origin, Annex 3, Chapter 5

Ministry of Agriculture and Forestry Decree on food hygiene at approved establishments 795/2014, Annex 2, Chapter 1.5

'Good Practices in Reindeer Slaughtering' is a guideline containing key instructions related to reindeer slaughtering.

Besides legislation, the material is based on the material and Tunne poro book by Veterinarian, Adjunct Professor Sauli Laaksonen. These have been complemented with the help of audit visits of the Porukkaoppi - porotalouden porukalle lisäoppia project to reindeer slaughterhouses in 2017–2019. The aim of this project funded by the European Social Fund was to prepare educational material regarding reindeer slaughtering.

The guide has been written for the operators and operating environments of slaughterhouses owned by reindeer herding cooperatives and reindeer herders.

The original guide (in Finnish) has been distributed as a supplement of the Poromies magazine in the 4/2019 issue and as an independent edition. The electronic version of the guide is available on Poronet (https://paliskunnat.fi/ohjeet_oppaat/Poroteurastus_laitosteurastus_2019.pdf) and the website www.virtuaaliteurastamo.fi. The English version is published online in Lapland University of Applied Sciences series. It is a part of teaching material in a project named RenResurs (Resurspool för entreprenörskap inom rennäringen med binäringar: Kvalitet i slakt och styckning), funded by Interreg Nord, Region Norrbotten and The Regional Council of Lapland.



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