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**HUNTING OF LARGE GAME IN NORWAY
HYGIENE PRINCIPLE AND REGULATION**

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1 INTRODUCTION

Currently, Norway is not an official Member state of the European Union. However, the two parties have a close relationship through the European Economic Area (EEA) agreement Norway has with the European Union. There are several differences and similarities between the Norwegian food safety rules and regulations and the rules and regulations for food safety in the European Union.

This work compares the present legal regulations, hygiene of game processing, and meat inspection between Norway and the European Union, including their similarities and differences.

Meat from wild game is regarded as a delicacy consumed for more special occasions. Wild game is in contact with an uncontrolled environment during their lifetime, compared to domestic animals reared in a more controlled environment and receiving veterinary control at several points. This could result in a wild animal being diseased while being hunted for human consumption. The wild game could come in contact with various species that are potentially diseased. Wild herbivores and omnivores are at higher risk of potentially ingesting contaminated material through grazing; the environment is constantly subjected to pollution by human activity. Depending on the kind of activity, a variety of contaminants may be spread to the surrounding environment.

In these uncontrolled environments, the risk of consuming meat from wild game is potentially higher than the domestic counterpart. Correctly handling wild game according to food hygiene principles is essential to prevent foodborne illness.

At what points do the regulations in Norway and the European Union differ, and could they have implications for the food safety of the final product?

2 HUNTABLE SPECIES

The Norwegian moose population is widespread throughout Norway except in some coastal regions in the west of Norway (Vestlandet) and along the coast from Lofoten and further north. The moose is primarily found in areas with coniferous forests, its preferred habitat [1].

The red deer and roe deer are widespread species found in most areas of Norway except in the northernmost regions where the red deer is rarely observed. There have been observations of the roe deer in the northernmost regions (Finnmark)[2] [3]. The red deer population in certain areas seasonally moves from the harsh highlands to the milder coastal regions during the winter [3].

In Norway today, the population of reindeer is receding and has, as of 2021, it has been classified as a near-threatened species on mainland Norway. Reindeer is only found in the south of Norway below Trøndelag on the mainland. In contrast, the Northern part of Norway is inhabited by domestic reindeer flocks. The largest wild reindeer flock is located at Hardangervidda, with approximately 6000 ± 200 individuals [4]. At Svalbard, there is a population of reindeer genetically different from the reindeer found on mainland Norway, called *Rangifer tarandus platyrhynchus* or simply Svalbard reindeer, which is smaller and has more compact fur and a more rounded skull compared to the main land reindeer. The Svalbard reindeer is classified as a most endangered subspecies of reindeer [5].

The population of the wild boar in Norway is located for the most part in the southern part of Norway, close to the Swedish border. Generally, they are found in south-eastern areas of Norway and have also been seen in the region of Trøndelag [6].

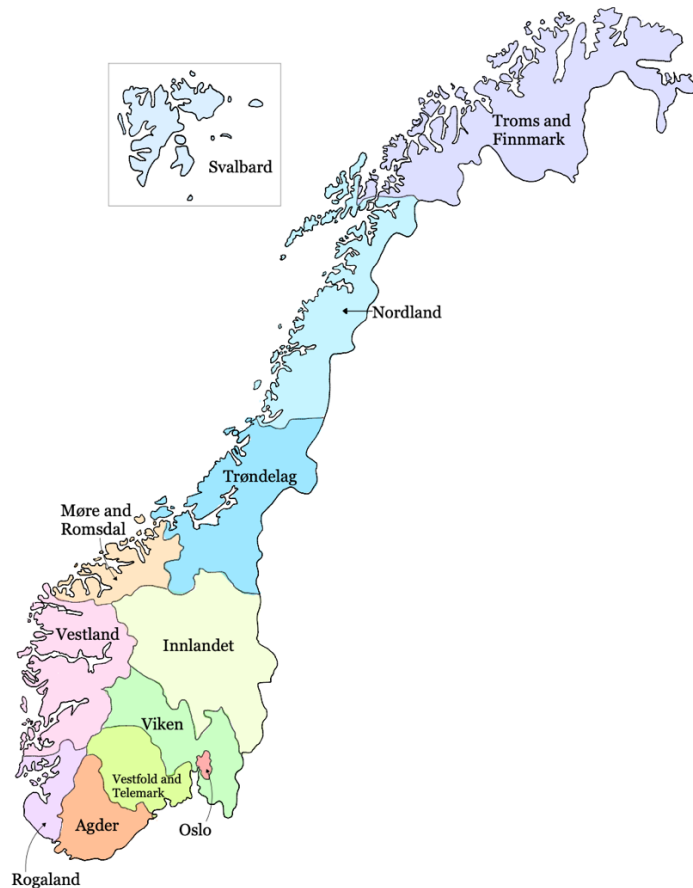
2.1 Moose - *Alces alces alces*

Its long legs and robust body characterize the moose. The legs are typically light gray, and the trunk is dark brown or gray. A male moose weighs between 380 kg and 700 kg, and a female moose weighs between 280 kg and 400 kg. The male moose can be seen with anthers, which are shed annually in the period between December and March. The average lifespan is 12 to 13 years [7].

The habitat the moose prefers is the boreal coniferous forest, which covers most of Norway except for the coastline along the counties of Troms and Finnmark, Møre and Romsdal, Vestland and Rogaland. The boreal coniferous forest in Norway consists mainly of *Pinus*, *Picea*, *Betula*, *Populus*, and *Alnus* [8].

Figure 1 Map over Norwegian counties.

[9]



This is a simplified map of Norway assorted into the different countries. The moose can be found in almost all counties of Norway except Svalbard; the counties with the most prominent moose populations are Nordland, Trønderlag, Innlandet, Viken, Oslo, Vestfold and Telemark, and Agder [7] (Fig 1).

The moose's diet during summer consists mainly of leafy trees and heather. The preferred tree species are common juniper, pine, willow, aspen, rowan, and birch. During the winter, the moose consumes twigs and bark from the trees, as mentioned earlier [1].

Hunting season for moose is declared by regulations for hunting, and hunting seasons are determined by the Ministry for Climate and the Environment. The hunting season for moose in Norway is in the majority of the counties from the 25th of September to the 23rd of December. The earlier start of the hunting season can be decided by the counties as long as it does not infringe on any other outdoor activities, such as hiking and camping [10].



Figure 2 Adult male Moose, the picture is taken in Sweden [11]



Figure 3 Adult female moose and her calf [12]

2.2 Red deer - *Cervus elaphus*

The red deer have short hair coats with a red-brown color during summer and longer guard hair with a grayer color during winter. The stag weighs around 250 kg, depending on age and maturity. The hind weighs on average about 120 kg. The stags develop anthers during their second year of life. The antlers have one simple main beam extending from the coronet. With advanced age, more points will come off the main beam. A crown-like structure is at the end of the main shaft in completely grown stags. The stags shed their antlers annually in May and April in Norway [2].



Figure 4 Red deer stag [13]

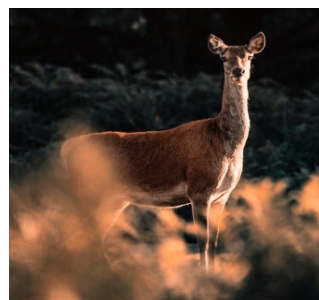


Figure 5 Red deer female [14]

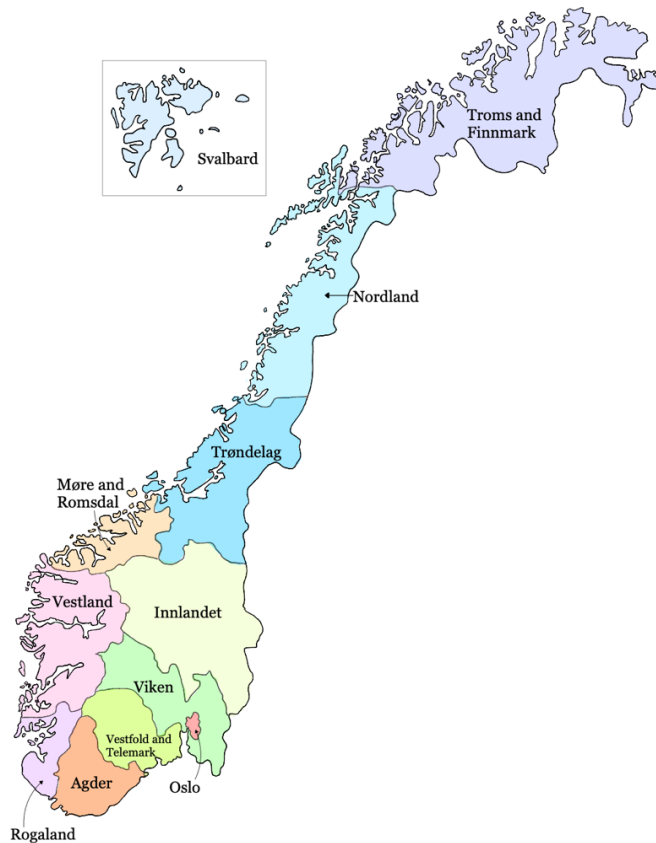


Figure 6 Map over Norwegian counties. [9]

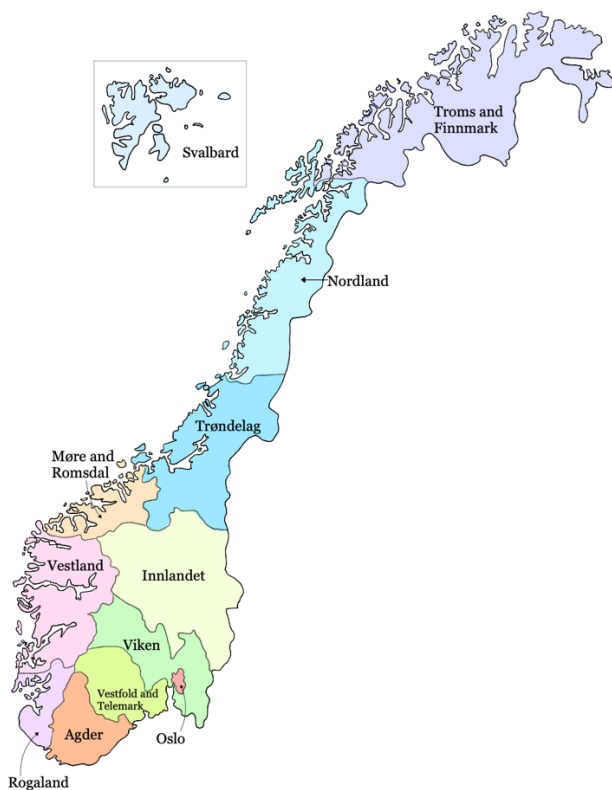
The red deer is primarily found in the southern part of Norway and rarely as far north as the county of Nordland. The counties with the most prominent red deer population are Trøndelag, Møre and Romsdal, Vestland, and Rogaland. The preferred habitat is forested areas; most deer herds move with the seasons. During the winter, the red deer prefer the lower altitude coastal areas with milder winters, and in the summer, they move to a higher altitude away from the coastal regions [2] (Fig 6).

The diet of the red deer during the summer consists of grass and other herbs. The diet in winter consists of grass, heather, twigs, and tree buds from leafy trees. The red deer also eats planted crops if the opportunity presents itself [2].

Regulations declare the hunting seasons for red deer for hunting and hunting seasons which determined by the Ministry for Climate and the Environment (Klima- og miljødepartementet). The hunting season for red deer in Norway is in most counties from 1st September to 23rd December. The earlier start of the hunting season can be decided by the counties as long as it does not infringe on any other outdoor activities, such as hiking and camping [10].

2.3 Roe deer - *Capreolus capreolus*

The roe deer has a red-brown coat color during summer and a more gray-brown coat color during winter. Mature roe deer commonly weigh between 18-36 kg. Antlers are present in male individuals and have a simple structure with less than three points from the main beam. The antlers are shed annually in April or May [3]. The preferred habitat is deciduous and coniferous forests close to agricultural areas since this offers safety, shelter, and easy access to their desired feed source. Populations of roe deer can also be found in mountain birch forests around the mountain pastures. The roe deer copes poorly with snow and prefers to be at lower altitudes and coastal areas in winter [3].



The roe deer is mainly found in Nordland, Trøndelag, Møre and Romsdal, Innlandet, Viken, Vestfold and Telemark, Rogaland and Agder. The roe deer has been recorded as far north as Troms and Finnmark [3] (Fig 7).

Figure 7 Map over Norwegian counties[9].

Regulations declare the hunting seasons for roe deer for hunting and hunting seasons are determined by the Ministry for Climate and the Environment (Klima- og miljødepartementet). The hunting season for roe deer in Norway is for individuals of roe deer who is not an adult male. The hunting period is from 25th September to 23rd December. There is a specified period separate for hunting adult males: 10th August to 23rd December. The earlier start of the hunting season can be decided by the counties as long as it does not infringe on any other outdoor activities, such as hiking and camping [10].



Figure 8 Roe deer buck [15]



Figure 9 Roe deer doe [15]

2.4 Reindeer - *Rangifer tarandus*

Reindeer fur has several shades and colors to receive optimal camouflage in different environmental surroundings. During summer, the coat ranges from gray and brown to red-brown coloring; during winter, the fur can be light brown or white-gray. Compared to other deer game, the reindeer have significantly thicker coats and can withstand negative 30 °C to 40 °C with minimal change to their basal metabolic rate. Both genders have antlers, and the calf starts growing their antlers in their first year of life. The body weight is most commonly below 100 kg, but males can reach weights of 150 kg [5].



Figure 10 Adult male reindeer [16]



Figure 11 Adult female reindeer [16]

The reindeer is typically found above the tree line, meaning trees cannot grow at such high altitudes. Specific herds are found at lower altitudes. The reindeer herd depends on being able to move over more extensive areas when the feed available in one place is diminishing [5].



The mainland reindeer is found in the red areas on the map. All sites further north are inhabited by the domestic reindeer flocks [17]. Reindeer can also be found at Svalbard [5] (Fig 10).

Figure 12 Map over Norwegian counties, red marked areas illustrate where wild reindeer can be found. [9]

The reindeer diet consists of reindeer lichen, star-tipped cup lichen, and other lichen species. Which contain easily accessible carbohydrates; the reindeer depend on particular gut bacteria that can digest the lichen and, therefore, need to be eating lichen even during summer, when the reindeer also consumes other plants and bushes [5].

Regulations declare the hunting seasons for reindeer; hunting and hunting season is decided by the Ministry for Climate and the Environment (Klima- og miljødepartementet). The hunting season for reindeer in Norway is in most counties from the 20th of August to the 30th of September. The counties can decide the start of the hunting season if it does not infringe any other outdoor activities such as hiking and camping [10].

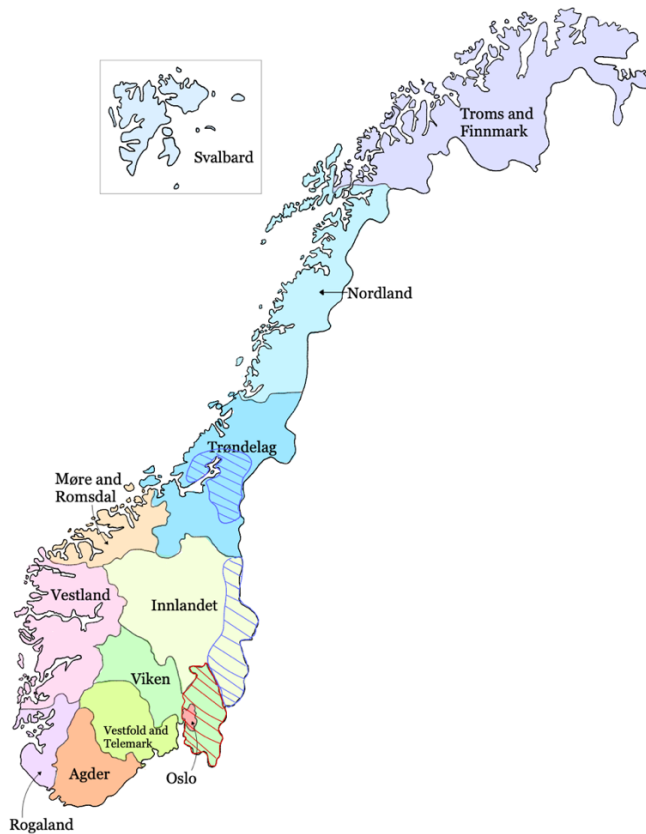
2.5 Wild boar – *Sus scrofa*

When they are juvenile, they have a light beige color with light brown strips; as they age, they turn red-brown, and adult animals have dark brown or black color. Adult male animals can reach a weight of around 250 kg and females around 150 kg. Male individuals have more prominent canine teeth from the upper and lower jaw; the teeth grow throughout their life [6]. It should be noted that the wild boar has for a long time not been present in Norway. However, their reappearance was registered in Norway in 1994, when some individuals were observed close to the Swedish-Norwegian border. Today, they can be found close to the Swedish border in the following counties: Østfold, Oslo and Hedemark. Since 2012, the species has been regarded as a foreign species with high invasion potential, and they pose a harmful infliction on the ecosystem and the risk of African swine fever infection from the wild boar to the domesticated pigs is a risk that should be considered [18].

Figure 13 Sow to the right and a young boar to the left [19].



Hunting seasons for wild boar are declared by regulations for hunting, and hunting season is determined by the Ministry for Climate and the Environment (Klima- og miljødepartementet). The hunting season for wild boar in Norway is in the majority of the counties from 1st April to 31st March. Sow with suckling piglets cannot be hunted, but piglets can be hunted throughout the year [10].



The areas marked with red are where most wild boar individuals in Norway have been observed, and the areas marked in blue are where a few individuals have been observed [18] (Fig 12).

Figure 14 Map over Norwegian counties where wild boar is located [9].

The wild boar is an omnivore, often digging in the ground to search for feed. Around 80% of their diet consists of plants, herbs, mushrooms, and nuts from oak and European beech trees [18].

3 POSSIBLE CONTAMINATION OF FEED OR WATER SOURCE

In the possible chemical contaminants, the toxic heavy metals are often need extra attention. Heavy metals can accumulate in plants consumed by wild living animals, including the wild game intended for human consumption. The heavy metals are naturally occurring in the soil. Human activities can influence the levels of heavy metal in the environment, for example, from agricultural or other industrial processes [20].

There is no available maximal level of cadmium and lead specifically for wild game (including ruminants and wild boar) set by the EU regulation 2023/915 for the set values for domestic bovine and swine are being utilized [21, 22].

	Maximal level	Comment
Cadmium; meat of bovine animal, sheep, pig, and poultry.	0.050 mg/kg	Excluding the offal.
Cadmium; liver of bovine animals, sheep, pig, poultry, and horse.	0.50 mg/kg	Excluding the offal.
Cadmium; kidney of bovine animals, sheep, pig, poultry, and horse.	1.0 mg/kg	
Lead; meat of bovine animals, sheep, pig, and poultry.	0.10 mg/kg	Excluding the offal. The maximum levels are regarding to the wet weight.
Lead; offal of bovine animals and sheep.	0.20 mg/kg	
Lead; offal of pig.	0.15 mg/kg	

[22]

Copper is an essential element found naturally in the soil or added to the soil using copper-containing pesticides. Copper can accumulate in the liver of animals due to the environmental pollution of their feed source. Since copper does not accumulate to any significant levels in the muscle tissue, copper does not pose a food safety risk when the liver is not used for human consumption [21, 23].

Chemical contamination of the feed source of the wild living game by copper leads to accumulation in their liver. According to the “Norwegian residue-monitoring program of veterinary medicinal products and some contaminants in live animals and animal products in

2019,” levels of copper in the liver were over the maximal limit in samples from 2 reindeer, 15 red deer, and 32 moose [21].

Cadmium is a heavy metal naturally present in the soil; due to environmental pollution, the amount of cadmium in the soil may increase. The cadmium is absorbed from the ground by the vegetation growing in it. The cadmium is further absorbed by animals grazing on the plants and can accumulate in organs like the kidneys and the liver. The cadmium can also accumulate in the muscles of large game grazing on the contaminated vegetation [20].

In the Norwegian residue monitoring program, high levels of cadmium were discovered in liver samples from 2 reindeer and 16 moose. When elevated liver values were found, a sample from the muscle tissue from the same individual was measured and did not have elevated cadmium levels. The Norwegian Food Safety Authority advises against that children below ten years should not consume liver from wild game, and adolescents and adults should restrict their consumption of liver from wild game [21].

Lead does not have an identified biological function and does not have any benefits for animals or humans; for this reason, lead is regarded as a non-essential element. If lead is ingested by a younger, pregnant, or lactating individual, it is absorbed more efficiently than an older individual. After the lead is absorbed, it is carried by the erythrocytes, mostly bound to the hemoglobin. At first, lead is found in soft tissues, and later, lead can form stable complexes with phosphate in the bones. The stored lead could be released during physiological events that enhance bone resorption, such as pregnancy, delivery, osteoporosis, or infection. Animals may come in contact with lead through contaminated soil. Lead accumulation is most significant in the spleen, kidney, and brain. Muscle tissue from hunted game may be contaminated with lead if lead-based ammunition is used; a perimeter around the channel of the bullet should then be removed and not consumed by humans or animals. Environmental contamination with lead can be found in areas around significant motorways due to the previous use of lead-based fuel; buildings painted with old paint, or where old batteries have been disposed of in nature. Lead is an element that may persist for an extended period in the environment [23].

Persistent organic pollutants (POPs) are widespread in live organisms; they can accumulate in the food chain, especially in fat tissue. Chlorinated hydrocarbons such as organochlorine pesticides and polychlorinated biphenyls are POPs. Exposure to persistent organic pollutants

(POPs) can have serious environmental and health effects, including adverse effects on the nervous, immune, endocrine, and reproductive systems. These chemicals may also increase the risk of developing certain types of cancer. It is essential to limit exposure to POPs to protect both human health and the environment. Due to these possible effects, the POPs organochlorine pesticides and polychlorinated biphenyls have been prohibited from utilization [24].

A study was taken regarding the geographical distribution of polychlorinated biphenyls and organochlorine pesticides in reindeer in Norway. Based on the measurements taken, it was observed that the concentrations found in the muscle tissue were mostly low. It was observed that regions with previous military trenches and mining activities or near the Russian border had higher concentrations than other regions. None of the measurements were above the maximum levels set by the EC 2023/915, and the reindeer meat would be considered safe for humans to consume [22, 25].

4 DISEASES

4.1 Chronic wasting disease (CWD)

Chronic wasting disease, also called transmissible spongiform encephalopathy, is a disease of red deer, reindeer, and moose. Chronic wasting disease is caused by the accumulation of prion proteins, particularly in the central nervous system. The first case of the disease in Europe was diagnosed in a free-ranging female reindeer in Norway in March 2016 [26].

CWD in reindeer is classified as Classic CWD, and the disease in deer and moose is classified as Atypical CWD. The classification is mainly based on the fact that in CWD in reindeer, the prions are primarily in the brainstem, and moose, the prions are diffusely throughout the brain. Another difference between the two CWD forms is that the prions are also found in reindeer in lymphatic tissue. The classic CWD can spread horizontally through fecal matter, urine, saliva, and the placenta [27].

The incubation time for CWD is months or even years before symptoms are shown. The affected animals lose significant body weight and exhibit abnormal behavior and movement patterns. The disease has no cure and is fatal [27].

Since the discovery of the disease in Norway, the Norwegian Veterinary Institute and Norwegian Institute for Nature Research have been testing samples from hunted and slaughtered red deer, moose, and domestic and reindeer [26]. The method used by the laboratory is Enzyme-linked immunosorbent assay (ELISA); if the ELISA test is positive, a western blot test or immunohistochemistry is used to verify the positive test [27].

In 2022, 17 584 deer game were tested for chronic wasting disease; atypical CWD was detected in two female moose and a female deer, and classical CWD was detected in one female wild reindeer. Since the start of the surveillance program in 2016 to 2022, classic CWD has been detected in 21 reindeer, and atypical CWD has been detected in 11 moose and three red deer. The surveillance program aims to test all wild reindeer that are above one year of age shot during the hunting season; according to the surveillance report from 2022, 86% of the shot reindeer (above one year of age) were tested [26].

There is no documented case of human disease due to contact with animals diseased with CWD. Still, as a precautionary measure, no animal afflicted with prion diseases shall enter the human food chain [27].

4.2 Echinococcosis

2022, a hunter submitted a moose to a wild game processing plant for inspection. On the lungs, vesicles were discovered, and further investigation confirmed that it was *Echinococcus granulosus sensu lato* genotype 10 (also known as *Echinococcus canadensis*). This is a notifiable disease in Norway due to its zoonotic potential [28].

The *Echinococcus* parasite requires a final host, canines, and an intermediated host, primarily a wild deer game. The intermediate host is infected with eggs from the parasite in the environment; the environment is contaminated by the infected canine animal's fecal matter. The canine host is infected when consuming tissue from infected wild deer game. Humans can be infected by eggs from the environment or by contact with faces of an infected canine animal [28].

Before the 1950s, *Echinococcus granulosus* was highly prevalent in the reindeer populations in the northern part of Norway. Today however, it is regarded as a rare disease. It was last detected in reindeer in 2003. The systematic treatment of dogs in contact with reindeer and advice to dog owners not to feed raw meat or offal to dogs significantly reduced the disease [29].

Echinococcus multilocularis has not been detected in mainland Norway; it is, however, seen in Sweden and at Svalbard. A surveillance program testing the Red fox has since 2002 tested 5548 foxes, where no positive test was produced. Norway has established traveling regulations for dogs entering Norway, where all dogs must be treated for *Echinococcus* by a veterinarian, and the treatment is written in the dog's passport [29].

4.3 Trichinosis

Trichinosis is a disease caused by the parasite *Trichinella* spp. The species relevant for Norway are *T. spiralis*, *T. britovi*, and *T. nativa*. Infection with *Trichinella* spp. transpires as the ingestion of cysts containing larvae found in the tissue of an infected individual. The ingested larva grows in the intestines and reproduces. The adult female releases larvae that migrate out

of the intestines and into muscle tissue. Due to the nature of infection, Trichinosis is mainly a disease of carnivores and omnivores. The parasite is zoonotic, and humans have been mainly infected from eating undercooked meat from wild boar. The disease is notifiable in Norway. All domestic pigs and horses slaughtered are tested for the parasite; the last recorded case in pigs was in 1994 [29, 30].

In 2015, a wild boar hunted in Norway tested positive for *Trichinella*; the specific parasite species was not investigated. A national surveillance program of wild boars was implemented in 2018, where hunters could submit samples from hunted wild boars for testing free of charge. In 2021, 292 wild boars were tested, and no *Trichinella* was detected [29, 30].

4.4 Papillomavirus in Red Deer and Moose

There are two different viruses in the two different species; in moose, it's the European Elk Papillomavirus (delta papillomavirus 1), and in red deer and roe deer, it is caused by delta papillomavirus 5. The papillomavirus in deer was recorded for the first time in 2019 in Norway. The papilloma growth occurs on the skin in the abdomen, thigh, and groin regions. Delta papillomavirus 1 and delta papillomavirus 5 are not zoonotic diseases, and since the lesions are mainly in the skin, the shot animal can be intended for human consumption. The virus is directly transmitted between animals and establishes itself in the skin via tears and small wounds. In addition, the virus may also be transmitted mechanically by insects that perforate the skin [28] [31].

In some cases, wounds and infection are on the warts, especially if they are of greater size. In case of infections, it is recommended to submit the carcass for inspection at a game processing plant. Some instances of infected moose have a more generalized form, with an extreme amount of papilloma lesions; they may also be emaciated, and the carcass should be condemned [28] [31].

The health surveillance program for wild animals (Helseovervåkingsprogrammet for vilt) documents the disease; hunters report animals with warts. In Norway, the disease is mainly found on the west coast (Vestlandet) [28].

5 LEGAL REGULATION

5.1 Regulations in Norway

All hunting and catching of game must adhere to the Law for hunting and catching of game (Game law) (“Lov om jakt og fangst av vilt LOV-1981-05-29-38 (viltloven)”). The law includes all wild-living mammals, birds, amphibians, and reptiles. The law declares the huntable game, their hunting season, and in what areas hunting is permitted. Hunting and catching game are prohibited between the 24th and 31st of December and on Good Friday, Easter Eve, and the first day of Easter. The Directorate will determine the areas and the quota for the huntable species. Then, the different municipalities can issue hunting and catching permission to the site hunters according to the Game law's criteria [32].

Hunting of large game may only be done by individuals over 18. To partake in hunting, the hunter must also attend an obligatory course that must be 30 hours long and followed by an electronic test that must be passed. The mandatory shooting test must be performed with the rifle used for hunting; first 30 shots shall be fired at an optional target. Then, five shots must be fired at the center of an animal-shaped target, which is certified by the directorate for the environment (miljødirektoratet); if the hunter intends to use more than one rifle, the five shots must be repeated with each rifle, the hunter plans to use. The 30 shots at the optional target is not needed to repeat for each rifle that will be used [33].

Only a rifle can be used when hunting moose, red deer, and reindeer. The use of a shotgun when hunting these species is strictly prohibited. The wild boar and roe deer may be hunted with a shotgun. For large game hunting, only a rifle or a shotgun may be used (depending on species); other weapons are strictly prohibited, such as revolvers, crossbows, pistols, fully automatic weapons, or semiautomatic weapons of military grade [33].

When hunting moose, red deer, wild boar, and reindeer with a semi-automatic rifle is not permitted to have more than one shot in the weapon chamber and three shots in the magazine. The ammunition used when hunting moose, red deer, and reindeer must expanding ammunition; the smallest allowed caliber is 6.5mm, and the minimal bullet weight must be 9 grams for bullets with lead core and 7.8 grams if the bullets are lead-free. The minimal allowed

impact energy in 100 meters is 2200 joule. When hunting, roe deer expanding ammunition must be used, and the minimal impact energy must be 980 joules measured with a distance of 100 meters. Shotgun ammunition must be of the slug type if the hunter intends to hunt wild boar. The slug-type ammunition may also be used to hunt roe deer [33].

Loose and driving hunting dogs may be used for hunting red deer and roe deer if the dog's height measured at the shoulder does not exceed 41 cm. Detection hunting dogs, which are used for hunting moose, red deer, and roe deer, must be certified. The dog and its handler must pass a test determined by the directorate for the environment (miljødirektoratet). Dogs must be marked with an electronic transponder for identification purposes (which is not mandatory in general for dogs in Norway) [33].

a) Hygiene for large game processing in Norway

In Norway, it is possible to become a field-control certified hunter; the field control can be performed on deer game, not wild boar, due to the risk of having *Trichinella* parasites. When the deer game is intended for sale and not only for personal consumption, the field control by a certified hunter shall be completed. The field-control certified hunter shall be competent in the deer game's normal anatomy, physiology, and behavior. Shall be able to recognize pathological changes that can affect food safety. The field-control certified hunter should know hygiene rules, correct handling, and transport of the hunted deer game, and be familiar with the laws and regulations around hygiene and selling deer game meat [34].

The field-control certified hunter shall when possible, observe the deer game ante mortem and evaluate the behavior towards humans and hunting dogs if they are used, evaluate the movement of the individual before shooting. If the field control certified hunter is not present before the shooting, the hunter who shot the animal shall convey the observation made antemortem. The field-control certified hunter can perform postmortem control of the carcass and organs. The Norwegian National Food Safety Authority (Mattilsynet) shall be informed if any pathological findings are discovered. If lead bullets are used, a 10cm radius around the bullet channel must be removed, and it is not suitable for human consumption; the lead fragments from the bullet have contaminated the meat in the area. Any area with visible damage to the meat shall be removed and unsuitable for human consumption [34].

The meat from deer game intended for large-scale sale or export must be controlled by a veterinarian from the Norwegian National Food Safety Authority (Mattilsynet) at a wild game processing plant. The meat will be given the health stamp if the meat is safe for consumption. Meat for smaller local businesses and restaurants or sold to acquaintances requires control by either a certified field-control hunter or by the National Food Safety Authority (Mattilsynet). Deer game meat in small amounts intended for personal use or distribution to acquaintances does not require control [34].

b) Meat inspection of large game in Norway

According to the Norwegian food law (LOV-2003-12-19-124 Matloven), every aspect of food production shall contribute to high food quality and safety. This also applies to any game products; every individual involved must maintain food safety at any step of the process [35]. To mark meat from the wild game with a health stamp, the meat inspection must be carried out under the supervision of an official veterinarian working at the Norwegian Food Safety Organization (mattilsynet), and the carcass must not have any pathological changes that can affect food safety and food quality [36].

The instructions for post-mortem inspection are stated in FOR-1994-05-25-369 (Instruks for kjøttkontrollen). Meat inspection of wild game shall adhere to the same standard as the closest domestic species; however, the antemortem control of wild-living game cannot be carried out in the same fashion as domestic animals. In Norwegian law, we have a farmed deer game and reindeer category. This is the closest category to the wild deer game. Farmed wild boar and domestic pigs are in the same category; therefore, the wild boar inspection will be executed according to the points listed in that section [37].

All incisions made during the inspection shall be made in a separate room from products intended for human consumption to avoid cross-contamination. What is listed below are the areas that must be incised, palpated, or inspected by law; if the official veterinarian deems any other investigations necessary based on findings, they will also be performed in addition to the steps listed below [37].

Postmortem examination of moose, red deer, roe deer and reindeer

1. The head is inspected after the animal has been skinned. If there is suspicion of pathological abnormalities or if parts of the head are intended for human consumption, then the oral cavity, pharynx, tongue, retropharyngeal, and parotid lymph nodes must be inspected, palpated, or incised.
2. Inspection of the lungs, trachea, and esophagus. Palpation of lungs, bifurcation, eparteriales and mediastinal lymph nodes. When there is suspicion of pathological changes, incisions are made to the organs and their accompanying lymph nodes.
3. Inspection of the heart and pericardium. The heart is opened in case of suspicion of pathological changes.
4. The diaphragm is inspected.
5. The liver and portal lymph nodes are inspected and palpated. The liver is incised to inspect the biliary ducts.
6. The gastrointestinal tract and the mesentery are inspected, and its lymph nodes are inspected.
7. Inspection of the spleen palpation if there is suspicion of pathological changes.
8. Inspection of the kidneys, if suspicion of pathological changes in kidneys and renal lymph nodes are incised.
9. Inspection of the pleura, peritoneum, genital organs, and udder.
10. In young animals, inspection and palpation of the umbilical area and joints. If there is suspicion of pathological changes, the umbilical region and joints are incised [37].

Postmortem examination of wild boar

1. The head and pharynx are inspected. Mandibular lymph nodes are incised and inspected. The oral cavity and pharynx are inspected carefully, and the tonsils are removed.
2. Inspection of lungs, trachea, and esophagus. Palpation of lungs, bifurcation, eparteriales and mediastinal lymph nodes. The trachea and the main bronchi are opened. When the lungs are not intended for human consumption, incision is not required.
3. The pericardium and heart are inspected. The heart is opened in a manner that allows for all chambers to be inspected, and the septum of the heart is incised and inspected.
4. The diaphragm is inspected.

5. The liver and portal lymph nodes are inspected and palpated.
6. The gastrointestinal tract and the mesentery are inspected, and the accompanying lymph nodes are palpated and incised to the extent the supervising veterinarian deems necessary.
7. Inspection of the spleen palpation if there is suspicion of pathological changes.
8. Inspection of the kidneys. Incision of the kidneys and the renal lymph nodes if there is suspicion of pathological changes.
9. Inspection of the pleura, peritoneum, genital organs, and the udder.
10. In young animals, inspection and palpation of the umbilical area and joints. If there is suspicion of pathological changes, the umbilical region and joints are incised.
11. When there is suspicion for cysticercosis, investigation of thigh musculature, diaphragm, intercostal muscles, heart, tongue, pharynx, and possibly abdominal wall and psoas muscles after the fat tissue has been removed.
12. Individuals with wounds, abscesses, phlegmons, or other abnormalities that may indicate sepsis shall be subjected to additional investigation in a separate area after the carcass has been halved, inspection of joints, pelvic symphysis, spinal column, and ribs. The sacral part of the spine is also examined paramedially by making incisions into the pelvic joints and pelvic symphysis. The internal pelvic and psoas muscles are inspected and palpated to identify abscesses in the area.
13. Testing for *Trichinella* species must be performed on each individual [37].

The diseases/conditions listed below shall result in condemnation of the entire carcass this list is the same for all animals presented for meat inspection domestic or wild.

- Actinobacillosis, generalized actinomycosis, anthrax, generalized tuberculosis, generalized lymphadenitis, tetanus, rabies, acute brucellosis, acute salmonellosis glanders, erysipelas, botulism, sepsis, generalized sarcosporidiosis, generalized cysticercosis and trichinosis.
- Emaciated, edema in the muscle tissue, several tumors, abscesses or damage at different locations or in several organs.
- Prominent discrepancy in color, odor, taste or consistency [37].

Partial condemnation of carcasses is warranted in the following situations:

- Partial edema or blood pooling, local abscesses, or contamination.

- Regions with pathological changes due to infections, parasites or trauma. Local lymphadenitis [37].

c) The field control

The antemortem control is performed to visually observe the animal before shooting. The animal is unsuitable for human consumption if any unusual behavior is observed. Postmortem control is performed after the animal has been shot and bled out (if shot in the head, neck, or spine). The animal is inspected externally, looking for any apparent damages. The internal organs are removed and examined for any pathological changes. The field-control certified hunter shall be familiar with the physiological appearance of the internal organs and muscle tissues. If any deviations from normal appearance are detected, the carcass shall be controlled at an official game processing plant by a veterinarian [34].

The certified field control hunter is responsible for food hygiene when handling the carcass. Any person who is sick, has infected wounds on their hands, shall not come in contact with the carcass. Knives, saws, and any other equipment that is in contact with the carcass shall be cleaned to prevent contamination of the meat. If all internal organs are without any changes, they may be left at the shot site; if pathological changes are visible, the organs should be brought together with the carcass to the game processing plant for meat control. Optimally, the carcass should be transported with all internal organs removed; transport must be carried out carefully to prevent physical damage or contamination [34].

When the carcass is being stored, it shall hang freely, not in contact with walls or anything else that may contribute to contamination. The abdomen should be pried open to allow for good air circulation. When the carcass is skinned and parted, the hunter shall use clean equipment and practice good hygiene. At this point, the meat may only be used for personal use, sold to a private person, as animal feed, or as bait. If it is to be sold to a private person, it can only be sold as one or more large pieces, not as steaks, fillets, etc.. To qualify to be sold to the market, it must be controlled at an official game processing plant [34].

The certificate that the field-control certified hunter can issue must include the following information: any pathological findings, what date and time the animal was shot, what projectile was used, species, gender, age (calf, yearling, or adult), signature, full name of the field

certified hunter and a phone number. A number must also be issued to the carcass; if the carcass is sectioned into smaller pieces, they must also be given a number. The first two digits must be the year. For example, 23 03/1 would be the year 2023, animal number 3, and part 1 of the carcass [34]. The field-control certified hunter may sell to stores or restaurants but is only allowed to divide the carcass into a maximum of 8 pieces and is not allowed to sell it as steaks, fillets, etc. Only at the official game processing plant can the carcass be reduced into fillets, steaks, etc., and sold freely to stores and restaurants in the European Union and Norway [38].

d) Meat control performed at an official game processing plant

They are required to have a hazard analysis critical control point (HACCP); good food hygiene routines and personal hygiene routines are obligated. With a separate clean zone and dirty zone, the water used must be of drinking quality. All byproducts of animal origin must be disposed of properly, for example, "Biosik," a disposal plant that destroys animal byproducts and reuses them in various products. The game processing plant must also have routines for keeping pests away, such as rodents, birds, insects, etc. The chosen material for floors, walls, work benches, and other equipment must be of a material that can be easily cleaned; porous materials such as wood should not be used. When the meat or carcass is kept at the game processing establishment, it must be stored in a refrigerated room with a maximum temperature of 7°C in the core of the carcass [36].

When a certified field control hunter has inspected carcasses, and no abnormalities have been discovered, the carcass does not need to be accompanied by internal organs when it is to be inspected at the official game processing plant. However, individual game processing plants may have different requirements for what must be included; the hunters are responsible for checking this beforehand. The carcass may arrive skinned or unskinned in a maximum of eight pieces; a number should mark each article [34].

For animals not inspected by a field control certified hunter, the carcass must arrive at the official game processing plant with all viscera and the head; the viscera may be removed at the shot site and collected into bags; the gastrointestinal tract does not need to accompany the carcasses to the game processing plant [39].

After the carcasses arrive, they are inspected by a veterinarian according to the postmortem inspection protocol as described in the "Meat inspection of large game in Norway" chapter.

5.2 Regulations in the European Union

a) The concept of hunting, the marketing and sale of hunted game

Legislation 178/2002 provides the general requirements of food law. By this legislation, the hunted game is classified as primary production and shall follow objectives stated in the regulation. The general objective of 178/2002 is to provide the consumer with safe food, fair trade of food, and, when possible, protect animal and plant health and the environment. Food and feed that adhere to this legislation and other relevant legislations may be exported and imported freely into the European Union [40].

Legislation 2019/627 gives the practical framework for executing the official control of animal products meant for human consumption in accordance with Regulation 2017/625 EC. The regulation 2017/625 provides the framework for official control, which the appropriate authority in the member states shall comply with, and this regulation revokes Regulation 854/2004 [41].

The framework of rules laid down by the regulation 2019/627 “should ensure a continuation of the requirements to ensure the verification of food business operators' compliance with the rules for the safe handling of products of animal origin, particularly as laid down in;” [41]

- Regulation 178/2002, general food law.
- Regulation 853/2004, specific hygiene regulations for animal-origin food.
- Regulation 2015/1375, official control of *Trichinella*.
- Among several other listed regulations regarding food safety, official control, and animal health, the three extrapolated examples are used to illustrate. They are the regulations with the most importance in this thesis [41].

The carcass of game animals and their viscera should be brought for official post-mortem inspection to a game processing plant to ensure adequate meat control of the carcasses sold to the community market. For specific hunting traditions that should be preserved, the hunters should be given appropriate training to ensure that only safe meat is sold to the market. This should make it possible for hunters to conduct the postmortem of the carcass on the spot. In certain situations, if qualified hunters do this first assessment and find no abnormalities or risks, they are not required to send all viscera to the game processing plant for post-mortem examination by an official veterinarian. Member States can enforce stronger regulations within

their borders. The regulations of meat control do not apply to private consumption and retail on a small scale [42].

At least one person in the hunting team must have sufficient knowledge of the pathology of wild game and proper handling of the carcass and the meat to ensure safe food if the intention is to put the meat on the market. By the legislation, they are referred to as “trained persons.” The “trained person” shall be educated to the appropriate authority set standard. The “trained person” must be competent in the following:

1. Normal anatomy and normal behavior of wild game
2. Pathological changes and abnormal behavior due to diseases or other factors may affect the meat's safety.
3. Hygiene and the correct handling, evisceration, and transportation of wild game.
4. The legislation that the hunters must follow [42].

b) Handling of hunted game

Proper handling of hunted game is essential to ensure the food safety of the final product.

The “trained person” observes the animal's behavior before the individual is shot, or the hunter makes the observation and conveys the information to the “trained person”. Animals with abnormal behavior are not safe for human consumption. The killed wild game must be bled out (if necessary, depending on where the fatal shot was delivered), and the individual must eviscerate as soon as possible. The “trained person” with the competence described above must inspect all viscera and the carcass; this examination must be performed as quickly as possible [42].

When the hunted ruminants are intended to be put on the market, the inspection can be carried out on the spot by the “trained person.” If no abnormalities are found on the offal, it does not need to accompany the animal to the official game processing plant. When meat from wild boars or other species with trichinella risk is intended to be put on the market, the head and diaphragm must accompany the carcass and be labeled in such a way that the correct diaphragm and head is recognized with the correct carcass and shall be presented at the official game processing plant for meat inspection. Individual Member states may impose stricter regulations regarding what viscera needs to accompany the carcass to the game processing plant. All carcasses that arrive at a game processing plant must be marked with a number and a

declaration with the following information: time, date, and location of killing; this must be filled out by the “trained person.” When a hunting team does not possess a “trained person,” then the head and all viscera, excluding the gastrointestinal tract, must accompany the carcass to the game processing plant if the intention is to sell the meat to the market [42].

Transport to the game handling plant, the carcasses shall not be piled on top of each other and should not be skinned before arriving. Chilling the carcass must be done reasonably soon as possible, and the meat's core shall not surpass 7°C [42].

c) Meat inspection of hunted game animals at a game processing plant

Ante-mortem inspection is a visual inspection carried out by the “trained person” and is performed before shooting the animal by observing if its behavior is normal [42].

In regulation, 2019/627 Article 28, the concrete arrangement for postmortem inspection of wild game is outlined and performed by the official veterinarian at the game handling establishment [41].

The official veterinarian carries out the post-mortem inspection, a visual inspection of the carcass, and, when appropriate organs, searching for anomalies. The veterinarian also considers information provided by the “trained person” in the hunting team. The veterinarian also confirmed that the animal's death was due to hunting. Inspection is performed by the veterinarian using their senses, visually inspecting the carcass and searching for any abnormal odors. Palpation and incisions of the organs are performed where appropriate [41].

In low-capacity game processing plants handling less than 1000 livestock annually, the official veterinarian can allow the quartering of the carcass of the adult large game before the meat inspection is performed with the reasoning to provide more optimal hygiene conditions [41].

In regulation 2019/627, the steps of the postmortem control are listed for each domestic species. The regulation states that farmed game shall be grouped into the most appropriate category. For instance, for adult moose, and red deer, the “other bovine animals” category is used, and for wild boar the “domestic swine” category is used this is applied to farmed game. There is no specific note in the regulation of what group wild game shall adhere to. The official

veterinarian can perform additional incisions, palpations, or other examinations if the veterinarian deems it necessary [41].

Postmortem examination of adult moose and red deer

The official veterinarian will execute these steps for each carcass.

1. Visually inspect the head and throat. Incision into the retropharyngeal lymph nodes and examine the cut surface. Two incisions parallel to the mandibula into the masseter muscle and into the pterygoid muscles and the cut surface are investigated through a comprehensive visual inspection of the oral cavity.
2. The trachea and esophagus are visually inspected. The lungs are visually inspected and palpated. The following lymph nodes, mediastinal, bifurcate, and eparteriales, are incised, and the cut surface is examined.
3. The heart and pericardium are visually inspected. The heart is then opened to visualize the ventricles, and the septum between the ventricles is incised as well and inspected.
4. The diaphragm, liver, and portal lymph nodes are subjected to a visual inspection.
5. The gastrointestinal tract and its accompanying mesentery are visually inspected; in addition, the following lymph nodes, gastric and mesenteric, are inspected and palpated.
6. Visual inspection of the following: spleen, kidneys, pleura, peritoneum, genital organs, the udder, and supramammary lymph nodes [41].

If the veterinarian discovers any signs while inspecting as described in the points above (points 1.-6.) that may pose a risk to human health, animal welfare, or animal health, the following procedures shall be performed (points 7.-12.) [41].

7. The mandibular and parotid lymph nodes are incised, the cut surface is examined, and the tongue and pharynx are palpated.
8. The mediastinal, bifurcate and eparteriales lymph nodes are incised and examined. The trachea and the three main bronchi are opened and inspected.
9. The lungs must be incised in their posterior third, parallel to the central axis; these incisions are not required if the lungs are not intended for human consumption.
10. Palpation of the portal lymph nodes and the liver, an incision is made on the visceral surface of the liver and into the caudate lobe to examine the bile ducts.
11. Incisions are made into the gastric lymph nodes, mesenteric lymph nodes, the kidneys, and renal lymph nodes. The spleen is palpated.
12. The udder and the supramammary lymph nodes are palpated and incised. Each udder quarter must be opened by an extensive incision, exposing the lactiferous sinuses. In

cases where the udder is not intended for human consumption, it is unnecessary to make an incision into the udder and its lymph nodes [41].

Postmortem examination of wild boar

The official veterinarian shall execute the points listed below (points 1.- 4) for each individual submitted for meat inspection.

1. The following is inspected visually: head, throat, oral cavity, pharynx, tongue, lungs, trachea, esophagus, pericardium, heart, and diaphragm.
2. The liver and portal lymph nodes are inspected visually. The gastrointestinal tract, the accompanying mesentery, and the following lymph nodes, gastric and mesenteric, are inspected visually.
3. The spleen, kidneys, genital organs, pleura, peritoneum, udder, and accompanying lymph nodes are inspected visually.
4. A visual inspection of juvenile animals' umbilical area and joints shall be performed [41].

If the veterinarian identifies certain signs that may indicate a risk to human health, animal health, or animal welfare, further investigation shall be completed as listed below (points 5.- 12.) [41].

5. The mandibular lymph nodes are incised and examined.
6. The lungs, mediastinal, bifurcate and eparteriales lymph nodes are palpated. The trachea and the three main bronchi are opened and inspected.
7. The lungs must be incised in their posterior third, parallel to the central axis; these incisions are not required if the lungs are not intended for human consumption.
8. The heart is opened, the ventricles are inspected, and the septum between the ventricles is also incised.
9. The liver, its accompanying lymph nodes, and spleen are palpated.
10. The gastric and mesenteric lymph nodes are palpated and may be incised if necessary.
11. The incision is made in the kidneys, renal lymph nodes, and supramammary lymph nodes.
12. The umbilical area and joints are palpated, and an incision is performed if necessary [41].

Regulation 2019/627 states that *bovines* and *Suidae*, including wild game, shall be investigated for cysticercosis; however, a competent authority may conclude that incisions to the masseter

muscle are not obligated if the serologic investigation is performed if the animal has been reared in an officially free area, or the prevalence has been proved with a 95% certainty that no cases of cysticercosis have been detected in all slaughtered animals in the past five years. Individuals infected with generalized cysticercosis are unfit for human consumption [41].

According to regulation 2015/1375, laying down the directives around testing for *Trichinella* parasites, wild game meat, and other meat that potentially could contain *Trichinella* parasites is obligated to be examined according to Chapter 1 or 2 of the regulation. In the case of wild boars, the sample must be taken from the tongue or diaphragm, which is the predilection site for the parasite [43].

Regulation 2019/627 states when there is suspicion of contamination or residues, an analysis shall be conducted, and the veterinarian shall wait for the results before concluding the carcass is fit for human consumption or unfit for human consumption. The regulation provides a list of findings that would declare the meat a risk to human health;

- Abnormal behavior of the animal.
- Generalized abscesses or tumors.
- Pathological changes in the spleen, liver, intestines, umbilical region, joints, or testicles.
- Foreign bodies that are not a result of the hunting, with discoloration in the region where the foreign body is found.
- Parasites, emaciation, recent peritoneal or pleural adhesions, and open fractures that are not recent.
- Extensive gas accumulation in the intestines is accompanied by discoloration.
- Other significant pathological changes [41].

6 DISCUSSION

Due to the EEA Agreement, Norway is a part of everything associated with food production. It must follow European regulations to have the same minimum standard across the European Union and the countries in the EEA agreement. This allows for the export and import of products across the borders of the European Union and the countries in the EEA agreement [44].

The Norwegian general food law and the European Regulation 178/2002 general food law aim to provide safe food for the consumer. Both laws state that the food hygiene rules must be applied at every point in the food chain to maintain good food safety and human health. Traceability of food at every step of food production must be obtained as stated in the general food laws. These laws lay down the basic framework on which other laws base their principles [35, 40].

“Trained person” and the Norwegian counterpart of field control certified hunter both are required to have more in-depth knowledge about anatomy, physiology, expected behavior, and possible pathological abnormalities. In Norway, the course to become a field-certified hunter must last at least one day; the national food safety authority (mattilsynet) has approved three organizations to provide the course. The EU regulation 853/2004 states that the education of hunters must be conducted to the satisfaction of the competent authorities to qualify hunters as “trained persons.” Leaving it up to the individual member states to define the details [34, 42].

The specifics around the official meat inspection have several similarities and differences. As stated in the 2019/627 European regulation, the official inspection is performed at the game processing plant; this is also the Norwegian law. The first significant difference is species categorization and what points must be inspected, palpated, and incised. In both the Norwegian law and the European regulation regarding the meat inspection, it is stated that if the veterinarian for any reason, feels a further examination is necessary, it will be performed in addition to the listed obligatory steps. The European regulation and the Norwegian law has a list of pathological changes that could be a human health risk that would need further investigation or condemnation of the carcass. In the European regulation, the list is specifically for wild game, while in the Norwegian law, the list is regarding all species [37, 41].

In Norwegian law, we have a specific category called; “Post-mortem examination of sheep, goats, farmed deer game and domestic reindeer.” since this is the most appropriate category, all wild deer game are inspected according to the points listed in this category. Wild boars are inspected according to the points listed in the “Post-mortem examination of swine and farmed wild boar.” In the European Union regulation 2019/627, for moose and red deer, the other bovine animal category is used, for roe deer (or small red deer of below 100kg body weight), the small ruminant category, and for wild boars, the domestic swine category is used [37, 41].

The 2019/627 regulation provides specific instructions for meat control that are split into what we can call a primary inspection, which is mainly visual. If abnormalities are discovered, a more in-depth secondary examination is performed with more palpations and incisions as part of the investigation. This results in less contact between the inspector, the carcass, and the viscera. In the Norwegian version, there is one list of steps to perform; for instance, it may only be visual inspection and palpation of an organ. An incision is made if pathological changes are suspected [37, 41].

Meat inspection of deer game Norway vs European Union.

The first point encompasses the inspection of the head; in Norway, it is a visual inspection only if suspicion of pathological changes or the head is intended for human consumption is the lymph nodes, tongue, pharynx, or oral cavity inspected, palpated, or incised. In the European Union, the primary inspection covers the head and throat. It is visually inspected, followed by incisions to the retropharyngeal lymph nodes and incisions in the internal and external masticatory muscles. If there is pathology or suspicion of pathology, the parotid and mandibular lymph nodes are incised, and the tongue and pharynx are subjected to palpation. While comparing the two regulations, the Norwegian is less invasive, while 2019/627 is more extensive at this step. Suppose the head is not intended for humans to consume. In that case, it is not subjected to in-depth investigation, where we could argue that the risk of contracting cysticercosis is present when the masticatory muscles have not been incised [37, 41].

Between 1990 and 2015, no cases of *Taenia solium* or *T. saginata* were reported in Norway. This could be from a lack of well-functioning reporting systems or less favorable environmental factors for the parasites in Norway. However, human cases were reported but could be tied to travel outside Western Europe [45]. The risk of contracting the parasite from

Norwegian meat is very low, and logically, the incision is not routinely performed in Norwegian meat control.

The inspection procedure for the lungs, esophagus, and the mediastinal, bifurcate, and eparteriales lymph nodes is almost identical in Norway and European legislation. However, in Norway, incisions are not made when there is no suspicion of pathological changes, while in European legislation, the lymph nodes are always incised. In both cases, the lungs are incised when there is suspicion of pathological changes. As previously mentioned in the section for specific instructions for meat control, the European regulation provides a specifically written protocol for where on the lungs to incise (what angle, etc.). At the same time, the Norwegian law has no such protocol. It is worth noting that the Norwegian and European regulations state that the lungs do not need to be incised if they are not intended for human consumption [37, 41].

Per Norwegian regulations, the heart and pericardium are inspected visually, and the heart is only opened in case of suspicion. The European regulations state that the heart is opened in addition to the visual inspection, and the intraventricular septum is also incised [37, 41].

The Norwegian and European regulations state that the diaphragm is visually inspected only. In European regulation, the liver and portal lymph nodes are visually inspected, and palpation and incisions are only performed if there is a suspicion of pathological changes. However, in the Norwegian regulation, the liver and portal lymph nodes are inspected and palpated, and the liver is incised to inspect the biliary ducts in every individual [37, 41].

Fasciola hepatica is a significant problem in sheep in Norway, mainly in the coastal areas, and since the deer game is groped with sheep, the incision is also performed. There have been several red deer infected with the parasite [46].

By Norwegian law for meat control of the gastrointestinal tract, the mesentery and lymph nodes are inspected visually. The same applies to the kidneys, spleen, pleura, peritoneum, genital organs, and the udder of female animals. If abnormalities are found, further investigation will take place [37]. It is more or less identical to the European legislation, except that the gastric and mesenteric lymph nodes are palpated. In the European legislation, details for what to inspect further are included if there is suspicion of pathological abnormalities [37, 41].

Meat inspection of wild boar Norway vs European Union.

The 2019/627 takes a primarily visual approach to the primary inspection where the carcass is only visually inspected; if abnormalities are found at any point, a more detailed examination with palpation and incisions shall be performed by the veterinarian as described in the regulation [41].

The Norwegian instructions for meat control state that the head and pharynx are visually inspected, the mandibular lymph nodes are always incised, and the tonsils are removed [37]. The lungs and accompanying lymph nodes will be inspected and palpated per the Norwegian meat control law instructions. The trachea and main bronchi must also be opened, as the lungs are not intended for human consumption; incisions of them are not obligated. The heart is opened and inspected; the intraventricular septum is incised and inspected. The liver is visually inspected and palpated. The diaphragm, gastrointestinal tract, mesentery, spleen, kidneys, pleura peritoneum, genital organs, and mammary glands are inspected visually, and further action is taken if abnormalities are found [37].

The Norwegian law has two additional points listed explicitly for the *Suidae* category, which is a point encompassing specifically what muscles shall be investigated if there is suspicion for cysticercosis and a point stating that if wounds or abscesses are found a more detailed inspection of the joints, pelvic symphysis, spinal column, ribs, and pelvic girdle muscles due to the risk of sepsis. Further investigation shall not be executed in the same area as healthy individuals to prevent cross-contamination [37].

The European Union and Norway guidelines both state that wild boar inspected by an official veterinarian shall be tested for *Trichinella* [37, 41].

The actual implementation of the visual-based *Suidae post-mortem* inspection is, in reality, primarily applicable slaughterhouses slaughtering individuals from herds where disease history is well known and where serological testing has been routinely performed. The basis for omitting the incisions and palpations during the meat control is a risk-based analysis of the herds and detailed food chain information, such as the health status of the herds. This information is obviously not available for wild boar [47].

7 CONCLUSION

As a first impression of how the laws are written, the Norwegian law gives more room for interpretation by the veterinarian performing the meat inspection. For example, what angle or exact position an incision has to be made is not stated in Norwegian law compared to European regulation.

The most significant difference between Norwegian law and European Union regulation for postmortem investigation is that the Norwegian approach is more hands-on and involves more incisions and palpation, while the European, on the other hand, is only visually performed unless there are abnormalities, then further investigative techniques are used. From one aspect, less contact with the carcass and organs does infer less risk of cross-contamination, while the visually-based investigation may miss specific pathologies. But since the visual post-mortem inspection is only done when there is no suspicion of pathology, Presumably official veterinarians at large game establishments prefer to make specific incisions and palpate certain organs to investigate wild boar carcasses since there is a significant lack of food chain information compared to the domestic-reared swine.

Meat being put on the market after being handled by a “trained person” or field-certified hunter who detected no abnormalities on their initial examination will not undergo a full meat inspection by an official veterinarian. When there are no abnormalities found in the field, all organs don't need to accompany the carcass [34, 42]. In this case, there is a lot of responsibility placed on this person, and one could argue that they are greatly motivated to be able to sell the meat with a profit; they could be more willing to let some minor abnormalities slide. Opposed to an official veterinarian employed by the government with nothing to gain if the carcass does pass the postmortem inspection.

The Norwegian law has been more tailored towards the specific areas with higher or lower risk than the European Union regulations, considering the many different member states. Like the cysticercosis investigation of the masseter muscle, since it is not common in Norway, investigating all carcasses is unnecessary to provide safe food. While cysticercosis is more prevalent in Eastern Europe, taking the time to explore the masseter muscle is required to provide safe food.

Despite these differences, it is essential to note that correctly handling wild game according to food hygiene principles is crucial in preventing foodborne illnesses. The risk of consuming meat from wild game is higher than domestic animals, given the uncontrolled environment in which they live and the possibility of exposure to various contaminants, as mentioned. Overall, the regulations and hygiene practices in the European Union and Norway aim to ensure the safety of wild game meat for human consumption. When hunters follow these guidelines, we can enjoy the delicacy of wild game meat while minimizing the risk of foodborne illnesses.

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9 REFERENCES

1. Bevanger K, Solberg EJ (2015) Elg *Alces alces* (Linnaeus, 1758). www.artsdatabanken.no/Pages/179464. Accessed 5 Apr 2023
2. Bevanger K, Veiberg V (2015) Hjort *Cervus elaphus* Linnaeus, 1758. <https://artsdatabanken.no/Pages/179473>. Accessed 25 Jan 2023
3. Bevanger K (2015) Rådyr *Capreolus capreolus* Linnaeus, 1758. <https://artsdatabanken.no/Pages/179482/Raadyr>. Accessed 1 Feb 2023
4. Syvertsen PO, Bjørge A, Kovacs K, Støen OG, Kooij JVD EK (2021) Vurdering av Rein Rangifer tarandus for norge. Rødelista for arter 2021. <https://artsdatabanken.no/lister/rodlisteforarter/2021/19057>. Accessed 5 Apr 2023
5. Bevanger K (2015) Rein Rangifer tarandus Linnaeus, 1758. <https://artsdatabanken.no/Pages/179491/Rein>. Accessed 20 Sep 2023
6. Bevanger K, Fjellbakk Å (2017) Villsvin *Sus scrofa* Linnaeus, 1758. https://artsdatabanken.no/Pages/225883/Villsvin__Sus_scrofa. Accessed 4 Mar 2023
7. Langvatn R (2022) Elg in Store Norske Leksikon. <https://snl.no/elg>. Accessed 5 Apr 2023
8. Solheim R, Tomter SM (2023) Den boreale barskogssone, Store norske leksikon. https://snl.no/den_boreale_barskogssone. Accessed 19 Sep 2023
9. Hannah Nummedal (2023) Map over Norwegian counties.
10. Klima- og miljødepartementet (2022) Forskrift om jakt- og fangsttider samt sanking av egg og dun for jaktseongene fra og med 1. april 2022 til og med 31. mars 2028, [Law]
11. Unsplash Adult male moose (picure). Accessed 5 Apr 2023
12. Unsplash Adult female moose and her calf. (picture). Accessed 5 Apr 2023
13. Unsplash Adult male red deer (picture)
14. Unsplash Red deer female (picture). Accessed 5 Apr 2023
15. John Linnell Roe deer, male and female (picture). <https://artsdatabanken.no/Pages/179482#:~:text=Rådyr%20er%20utsatt%20for%20predasjon,utsatt%20for%20parasitter%20og%20sykdommer>. Accessed 11 Sep 2023
16. Nyaas A Adult male and female reindeer (picture). <https://villrein.no/om-villrein/>. Accessed 21 Sep 2023
17. Tveraa T, Gundersen V, Røed KH, Tømmervik H, Kvie K, Våge J, Skarin A, Strand O RC (2022) Klassifisering av de ti nasjonale villreinområdene etter kvalitetsnorm for villrein. Første klassifisering – 2022. NINA 2126:

18. Pedersen HK, Swenson JE, Syvertsen PO (2018) Sus scrofa, vurdering av økologisk risiko. Fremmedartslista 2018. <https://www.artsdatabanken.no/fab2018/N/161>. Accessed 4 Mar 2023
19. Kindberg J Adult wild boar and a young wild boar. (Picture). <https://www.artsdatabanken.no/Pages/225883/Villsvin>. Accessed 21 Sep 2023
20. Zwillinger D, Bartha A, Lányi K, Laczay P LJ (2017) Food safety aspects of primary environmental contaminants in the edible tissues of roe deer (*Capreolus capreolus*). *Environ Sci Pollut Res* 24:. <https://doi.org/10.1007/s11356-017-0206-9>
21. Waleed A (2020) Overvåking av legemiddelrester og noen forurensende stoffer i animalsk mat og landdyr. *Mat*
22. European Parliament, Council of the EU (2023) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006
23. Backelin M (2014) Food-toxicological judgment of heavy metal content in the muscle of roe deer (*capreolus capreolus*). University of veterinary medicine Budapest
24. Niewiadowska A, Kiljanek T, Semeniuk S, Żmudzki J (2013) Organochlorine Pesticides and Polychlorinated Biphenyls in Game Animals from Poland. *Bulletin of the Veterinary Institute in Pulawy* 57:197–201. <https://doi.org/10.2478/bvip-2013-0036>
25. Hassan AA, Nøst TH, Brustad M, Sandanger TM (2021) Concentrations and geographical patterns of persistent organic pollutants (POPs) in meat from semi-domesticated reindeer (*Rangifer tarandus tarandus* L.) in Norway. *Science of The Total Environment* 798:149278. <https://doi.org/10.1016/j.scitotenv.2021.149278>
26. Våge J, Hopp P, Benestad SL, Viljugrein H, Solberg EJ, Andersen R, Strand O, Madslie K, Tarpai A, Veiberg V, Heim M, Holmstrøm F, Mysterud A RC (2023) Kartlegging og overvåking av skrantesjuka (chronic wasting disease - CWD). *Nor vet ins* 14:
27. Madslie K, Benestad SL, Vikøren T VJ (2019) Skrantesjuka (CWD) – en alvorlig sykdom med store konsekvenser - oppdaget ved god helseovervåking og samarbeid. *Nor vet ins* 9:584–589
28. Vikøren T, Ytrehus B, Rokseth Reiten M, Nymo IH, Davidson RK, Mørk, T Hamnes IS, Neves C, Tarpai A, Granstad S, Hagelin J, Solberg EJ, Kolbjørnsen Ø, Tessema GT, Agdestein A, Våge J MK (2023) Helseovervåkingsprogrammet for vilt 2022. Norwegian veterinary Institute 9:
29. Hauge K, Bruland Lavoll S, Lange H, Lyngstad TM JH (2022) The Norwegian Zoonoses Report 2021. Norwegian veterinary Institute
30. Thurfjell H, Flø D, Grahek-Ogden D, Malmstrøm M, Nesbakken T, Neves CD, Nielsen A, Pedersen HC, Robertson L, Rueness EK, Boer HD, Gudding R, Hoel K, Kirkendall L, Vandvik V, Wasteson Y SE (2018) Wild boar population growth and expansion - implications for biodiversity, food safety, and animal health in Norway. Opinion of the Norwegian Scientific Committee for Food and Environment. VKM 14:

31. Norwegian Veterinary Institute (Veterinærinstituttet) Hudvorter hjå hjortedyr. In: Norwegian Veterinary Institute (Veterinærinstituttet). <https://www.vetinst.no/sykdom-og-agens/fibropapillomatose#:~:text=Analysar%20av%20hudvorter%20frå%20norsk,via%20riffter%20og%20små%20sår>. Accessed 14 Nov 2023
32. Landbruks- og matdepartementet K- og miljødepartementet (1982) Lov om jakt og fangst av vilt (viltloven) [Law]
33. Landbruks- og matdepartementet K- og miljødepartementet (2002) Forskrift om utøvelse av jakt, felling og fangst [Law]
34. Bakka D (2022) Bransjestandard for feltkontroll av horte viltkjøtt. https://skogkurs.no/wp-content/uploads/bransjestandard_2022_hefte.pdf. Accessed 6 Apr 2023
35. Health Department (2003) Lov om matproduksjon og mattrygghet mv. (matloven) [Law]
36. Landbruks- and matdepartementet, Helse- and omsorgsdepartementet F (2008) Forskrift om hygieneregler, animalske næringsmidler. [Law].
37. Sosialdepartementet (1994) Instruks for kjøtt kontrollen [Law].
38. Heglebäck I (2021) Mattilsynet, Forskriftendring- Viltkontrollsteder avvikles.
39. Mattilsynet (2023) Viltkjøtt. <https://www.mattilsynet.no/mat-og-drikke/matproduksjon/viltkjott>. Accessed 25 Sep 2023
40. European Parliament, Council of the EU (2002) The general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.
41. European Parliament, Council of the EU (2019) laying down uniform practical arrangements for the performance of official controls on products of animal origin intended for human consumption in accordance with Regulation (EU) 2017/625 of the European Parliament and of the Council and amending Commission Regulation (EC) No 2074/2005 as regards official controls
42. European Parliament, Council of the EU (2004) EC 853/2004 Laying down specific hygiene rules for food of animal origin.
43. European Parliament, Council of the EU (2022) Laying down specific rules on official controls for *Trichinella* in meat
44. European Parliament, Council of the EU (1994) EØS-avtalen – Avtale om Det europeiske økonomiske samarbeidsområde. [Law]
45. Laranjo-González M, Devleeschauwer B, Trevisan C, Allepuz A, Sotiraki S, Abraham A, Afonso BM, Blocher J, Cardoso L, Correia da Costa JM, Dorny P, Gabriël S, Gomes J, Gómez-Morales MÁ, Jokelainen P, Kaminski M, Krt B, Magnussen P, Robertson LJ, et al. (2017) Epidemiology of taeniosis/cysticercosis in Europe, a systematic review: Western Europe. BMC. <https://doi.org/10.1186/s13071-017-2280-8>

46. Norwegian veterinary institute Den store leverikten (*Fasciola hepatica*).
<https://www.vetinst.no/sykdom-og-agens/den-stor-leverikten-fasciola-hepatica#:~:text=I%20Norge%20forekommer%20leveriktene%20helst,betydning%20for%20storfe%20og%20sau>. Accessed 1 Nov 2023
47. Hoelzer K RL (2020) Implementation of Visual-Only Swine Inspection in the European Union: Challenges, Opportunities, and Lessons Learned. *J Food Prot* 83:.
<https://doi.org/10.4315/JFP-20-157>