

SÁMI GASTRONOMY: THE ROLE OF TRADITIONAL KNOWLEDGE

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Traditional knowledge in food security is important for achieving sustainable food production systems. One example of food security is tenderness and meat quality. This article investigates the lack of Sámi reindeer herders' knowledge of meat tenderness and explores its relation to gastronomy and food sovereignty. Sámi family-produced reindeer meat is regarded as tender, while such meat is rarely available for visiting tourists. Therefore, a multidisciplinary approach combines different knowledge of meat tenderness in this article. When slaughtering in cold temperatures, a common slaughtering procedure is performed: *dievás njuovvat* (slaughtering reindeer outdoors on the ground) and *bakkahit* (a deliberate action of reindeer herder to leave the rumen inside the reindeer for tenderization). Decrease in intramuscular pH in sirloin, *longissimus dorsi*, from the *baggan* reindeer supports Sámi traditional knowledge of high-quality meat. In the Sámi language there are a variety of concepts that include knowledge of slaughtering practices and quality of meat. This is the first scientific study of Sámi reindeer herders' traditional knowledge and their specialist language of reindeer meat quality. The Sámi language is a prerequisite for the food sovereignty governed by Sámi reindeer herders' families through generations, regardless of state policies and modernization. Everyday food from Sámi households could offer an important template for future Sámi gastronomy, and lead to stronger food sovereignty and improved food for visiting tourists.

Key words: Food sovereignty, indigenous knowledge, tenderness, reindeer meat, tourism

Introduction

Reindeer husbandry is an Arctic nomadic civilization that goes back more than 2000 years (Fedorova, 2000), comprising more than 24 different

indigenous peoples and 2.5 million domesticated reindeer (Magga et al., 2011). Sámi reindeer husbandry is a livelihood for less than 3,000 people in the Norwegian part of Sápmi (County Governor of Troms and Finnmark, 2020). After the World War II,

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reindeer husbandry in West Finnmark in Northern Norway was still a nomadic livelihood, and it was argued that rationalization and modernization was needed for it not to be lost (Vorren, 1946). As part of this modernization process in Norway, a substantial amount of research on reindeer was carried out, including research on the tenderization of meat (Wiklund et al., 2019). Reindeer meat is extremely tender; it tenderizes fast and meets its final pH level quickly because of the composition of the muscle fiber (Wiklund et al., 1997). Compared with beef, reindeer meat has lower blood inhibitor levels and higher proteolytic enzyme activity, breaking long protein molecules into amino acids (Barnier et al., 1999; Wiklund et al., 2001). Scientific studies on reindeer meat quality focus mostly on biological aspects, such as dark, firm, and dry (DFD) meat, pH values, blood metabolites, and fatty acids (Sampeles, 2005; Wiklund et al., 2019).

Sámi family-produced reindeer meat is regarded as tender, but such meat is rarely available for visiting tourists. According to Kramvig and Førde (2020), many tourists seek knowledge about ways of living in the Arctic. There is little documentation and discussion of reindeer herders' traditional knowledge about reindeer meat and tenderization. Recently, Hansen et al. (2020) argued that reindeer herders' traditional knowledge about smoking of reindeer meat needs inclusion across scientific disciplines through self-determination or coproduction of knowledge, as the basis for food sovereignty and food governance.

Sustainable food systems should ensure food security and nutrition on all levels, without compromising opportunities for future generations (Hebinck, 2018; HLPE, 2014). "Food sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems" (Declaration of Nyéléni, 2007, p. 1). Food sovereignty was coined in 1996 by La Via Campesina (2003) and is a condition for achieving sustainable food security within food systems while sustaining the socioecological systems where food production takes place. In order to fulfill the criteria for food sovereignty, food must cover at least six pillars of food security: availability, supporting indigenous culture, indigenous decision-making power and management,

health and wellness, stability of food supply and accessibility (Inuit Circumpolar Council-Alaska, 2015, 2018; Burgess et al., 2018). Sustainability in food production is achieved through respecting all spheres of knowledge (Kaiser, 2020).

Governance systems must acknowledge traditional knowledge during changing times in the Arctic (Eira et al., 2018). Furthermore, even though scientific knowledge is of greatest importance to the governance strategy behind Sámi reindeer husbandry, the Sámi worldview still influences everyday life in reindeer herders' homes, despite 40 years of policy transformations (Eira et al., 2018; Reinert, 2012). Kaiser (2020) concluded in a Science-Traditional Indigenous Knowledge Seminar: "indigenous food culture can be a guide and maybe a benchmark for more ethical and more sustainable food in the future." A "keystone to develop future food security and food sovereignty" in Sápmi is the knowledge about sustainable food systems (Nilsson, 2018, p. 191). The food provided to visiting tourists in Norway is generally based on industrially processed reindeer meat, and not on Sámi knowledge and culture. "The growing interest for culinary products and traditions implies that food is also becoming a more important factor to influence tourists' motivations to travel to a particular destination" (Gyimóthy & Mykletun, 2009, p. 259).

This article discusses how Sámi reindeer herders' knowledge of meat quality can strengthen food sovereignty and be used to improve the sustainable economy of reindeer herders by, for instance, providing high-quality Sámi food products to visiting tourists. The unique quality of the reindeer meat, a result of the nature of the northern grazing areas and the culture and knowledge of Sámi reindeer husbandry, expresses Sámi gastronomy. So far, the food sovereignty and gastronomy of the Sámi peoples have been poorly understood. Therefore this article further investigates traditional knowledge, historical sources, photographs, semistructured interviews of Sámi reindeer herders and food authorities, and intramuscular pH measurement.

Slaughtering practices and quality of meat are expressed in the Sámi language with a variety of concepts. These include Sámi traditional knowledge of meat quality—for example *bakkahit* (a deliberate action by reindeer herder to leave the rumen inside the reindeer for tenderization), *dipmat*

[become soft(er) or tender], and *rotnu* (female reindeer that has not had a calf in the present year or that has lost the calf in the spring).

Food security means the access to nutritious, culturally appropriate and high-quality foods (HLPE, 2014). The Sámi traditional slaughtering procedures include actions to ensure high quality through meat tenderness. Traditional Sámi slaughtering methods have been viewed by non-Sámi to be unclean and therefore restricted by regulations (Skjenneberg & Slagsvold, 1968). This study uses a multidisciplinary methodology to show that in fact Sámi slaughtering should be considered clean and has the potential to increase food security as well as to be a path towards food tourism through high-quality meat products. This argues for food sovereignty as an important aspect of achieving sustainable food security within indigenous food production systems. This is the first scientific study of Sámi reindeer herders' traditional knowledge and their specialist language of reindeer meat quality (R. B. M. E. Sara & Eira, 2020). Sámi traditional knowledge and family-based food should be supported by a new kind of food governance to benefit reindeer herder's economy in fields such as tourism.

Sámi Food Sovereignty and Sámi Gastronomy

Food governance has a major influence on food systems and new governance mechanisms create collaborations between various actors (Hebinck, 2018). Recognition of indigenous peoples' philosophies on food systems could contribute to food security policies (Huambachano, 2015). While food governance is a system of rules and institutions managing food systems (Hebinck, 2018), food sovereignty is the right of indigenous peoples to define their own food systems and produce food with their own methods (Declaration of Nyéléni, 2007; La Via Campesina, 2003).

Gastronomy means "the art of good eating" with a multidisciplinary approach (Scarpato, 2002, p. 52) covering production, cultural values, economy, storage, transport, geography, and nutrition (Bernardo & Rodrigues, 2020; Gillespie & Cousins, 2001). In nature-based food production, the utilization of landscape links the place to the uniqueness of the food (Bele, Sickel, & Norderhaug, 2017).

Gastronomy differentiate between cultures, sustain and develop tourism in the areas (Oliveira et al., 2020).

Many scholars, both indigenous and nonindigenous (Eira, 2012; Guttorm, 2011; Johnsen, 2018; M. N. Sara, 2015; Turi, 2010), use the concept of traditional knowledge when discussing indigenous peoples' knowledge. Yet others use the terms indigenous knowledge (Inuit Circumpolar Council-Alaska, 2015; Johnson et al., 2016) and traditional indigenous knowledge (Eira et al., 2018). Traditional knowledge is defined in many ways and has several layers (Eira & Hætta, 2015). One definition is a systematic way of thinking and knowing that is transmitted through indigenous languages, is still in use, and is being developed and verified from generation to generation through a living process by "cultural practices, lived experiences and multigenerational observations, lessons and skills" (Arctic Council Permanent Participants, 2015). Indigenous knowledge is rooted in the land and maintained by indigenous knowledge holders interacting with the environment and securing their livelihood. It is holistic, dynamic and systematic and is tested and validated over time (Berkes, 2012; Johnson et al., 2016; Molnár & Berkes, 2018; Nakashima et al., 2018) by articulation of a worldview and transmission of knowledge through oral narratives (Huambachano, 2019).

This article uses *Sámi traditional knowledge* when referring to Sámi reindeer herders' knowledge about their food and the art of food preparation. A prerequisite for maintaining a knowledge about indigenous food systems is the use of the language. Therefore, a comparative analysis of Sámi concepts for reindeer slaughtering and meat quality are shown in Table 1, compared with linguistic interpretation (Nielsen, 1979) and reindeer herders' insights and understandings.

Sámi food is mostly made from fish and reindeer meat, with self-governing knowledge. Knowledge about reindeer, slaughtering practices, meat quality, and food consumption is still alive in Sámi communities and homes and is expressed in meat of unique quality, which is defined as Sámi gastronomy (Fig. 1). It is the quality of the entire process, from the reindeer herd grazing on the land to the meat being served, and the knowledge in all steps of the process. A process for which

Table 1
Sámi Concepts Related to Slaughtering and Food Sovereignty

| Sámi Concept | Definition |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>baggat</i> | Rumen become very much swollen, full of wind, distended, for instance in a reindeer. |
| <i>bakkahit</i> | A deliberate action to tenderize meat when slaughtering reindeer, to let the carcass stomach blow up after the esophagus is tied. A slaughtering action performed mostly on large and old reindeer, but also on younger reindeer. If the reindeer is left too long to <i>baggat</i> , then the fat around the rumen becomes brown. |
| <i>baggan</i> | The rumen of the reindeer is distended, very much swollen, full of wind after euthanizing, and lying with rumen inside for a while. |
| <i>dieváš njuovvat</i> | Slaughtering reindeer outdoors on the ground is a Sámi traditional way to slaughter. Everything from the reindeer is utilized, as meat, blood, heart, liver and intestines, sinews, skin and leg skins, antlers, and hooves. |
| <i>dipmat</i> | Become soft(er) or tender. After using <i>baggat</i> -method during slaughtering or cooking meat for a while then the meat becomes softer. |
| <i>dipma biergu</i> | Soft/tender meat. |
| <i>garra biergu</i> | Tough meat. |
| <i>gorut</i> | A slaughtered carcass where the legs are cut from the bends of limbs and the skin and head is removed while the neck remains on the carcass. A carcass is slaughtered as <i>gorut</i> when the meat is intended for commercial purposes. |
| <i>hersko</i> | Very good and delicate food, the best quality. |
| <i>málle-čovaji</i> | Reindeer rumen turned inside out and filled with rumen content and blood. A rumen can also be filled with only blood (Sámi: <i>varra-čovaji</i>). |
| <i>mievkkis</i> | Soft. Concept used to explain the consistency of reindeer meat or prepared reindeer skin as pliable, supple. |
| <i>niesteboazu</i> | A reindeer chosen for food to the family, usually a female without a calf, <i>rotnu</i> . The reindeer must be in good shape and fat and is an animal that has produced some calves, or none at all. |
| <i>oruhit</i> | Leave a reindeer for a while after euthanizing. It is not certain the carcass will <i>baggat</i> but it is left for an hour for tenderization purposes. |
| <i>rotnu</i> | Female reindeer that has not had a calf in the present year or which has lost the calf in the spring. |
| <i>rumbu</i> | A carcass where the legs are cut from steak and shoulder and is partly dissected, where intestines and rumen are removed but the skin is halfway off. The head, neck, legs and hooves of the reindeer are packed inside the carcass and the skin is tightened around with the leg skins. Slaughtered as a <i>rumbu</i> also softens the meat because it is packed inside the skin, makes transportation easier and keeps the meat clean. |

a Sámi term needs to be coined, where the best quality food is denoted *hersko* (good and delicate food, the best quality) (Nielsen, 1979) in northern Sámi. According to Oliveira et al. (2020), the whole process of food creates experience and gives the food authenticity. Eating a local dish helps to create authenticity, but “the whole process involves more characteristics rather than just the food, for the authenticity to be genuine and meaningful, the food must carry the culture together” (p. 151).

By serving Sámi food to visiting tourists, they are included in Sámi food heritage through storytelling and knowledge about the food. Heritage is the relationship where the past is brought to the present and heritage tourism invites individuals to engage in values from the past that are significant today (Palmer & Tivers, 2019). Culinary heritage

values the existence of a group of people living in a certain place and promotes and safeguards the areas’ history (Oliveira et al., 2020). Culinary heritage also promotes slow food and small-scale production (Gyimóthy & Mykletun, 2009). Tourists appreciate such gastronomic experiences when assessing the destination’s variety of products offered (Bernardo & Rodrigues, 2020; Oliveira et al., 2020).

Methodology

This article is based on multidisciplinary methods (Eira, 2012; Tengö, Brondizio, Elmqvist, Malmer, & Spierenburg, 2014; Tyler et al., 2007), using multiple sources and combining several knowledge systems. The similarities, complementarities, and disagreements thereby provide a more complex



Figure 1. Sámi gastronomy: A Sámi reindeer herder cooking reindeer meat over the fire for the family in a Sámi traditional tent, *lávvu*. Picture by Andreas Ausland/International Centre for Reindeer husbandry.

understanding and a broader perspective (Johnsen, 2018; Tengö et al., 2014). Methods applied are historical data analysis, interviews with knowledge holders (Eira, 2012; Johnsen, 2018), analysis of Sámi concepts (Eira, 2012) relating to reindeer and slaughtering, and meat quality measurement

(Wiklund et al., 1997; Wiklund et al., 2019; Wiklund et al., 2000).

Firstly, semistructured interviews (Eira, 2012; Johnsen, 2018) were carried out with reindeer herders and other experts in reindeer slaughtering. Eleven people (Table 2) shared their knowledge through

Table 2
List of Knowledge Holders

| Knowledge Holder | Female/Male | Area | Year of Interview |
|----------------------------------------------------------------------------------------------|-------------|------------------------------------------------------|-------------------|
| Reindeer herder A | M | Sámi, West Finnmark, Norway | 2008 |
| Reindeer herder B | M | Sámi, West Finnmark, Norway | 2019 |
| Reindeer herder C | F | Sámi, West Finnmark, Norway | 2019 |
| Reindeer herder D | M | Sámi, West Finnmark, Norway | 2019 |
| Reindeer herder E | M | Sámi, West Finnmark, Norway | 2018 |
| Reindeer herder F | M | Sámi, Rørosen, Norway | 2017 |
| Reindeer herder G | F | Nenets, Yamal-Nenets Autonomous Okrug, Russia | 2019 |
| Reindeer herder H | F | Even, Topolinoe, Republic of Sakha (Yakutia), Russia | 2019 |
| Reindeer herder I | M | Dolgan, Republic of Sakha (Yakutia), Russia | 2019 |
| Veterinarian 1: County veterinarian in Troms & Finnmark, previous vice-minister and minister | M | Norwegian, Nordland, Norway | 2019 |
| Veterinarian 2: Senior food safety veterinarian | M | Norwegian, Troms and Finnmark, Norway | 2019 |

these interviews. Five reindeer herders from Guovdageaidnu/Kautokeino, Northern Norway (Fig. 2) were interviewed in the Northern Sámi language, and one Southern Sámi reindeer herder from Southern Norway was interviewed in Norwegian. For comparative views, interviews with indigenous peoples in Russia, Nenets, Dolgan, and Evens, were made in English with the help of a Russian translator. The interviewees were between 30 and 80 years old, and everyone was involved in reindeer husbandry. As well as the data from reindeer herders, material from interviews with

two veterinarians was used. The interviews were conducted in private homes, in offices, in public areas, and through communication channels on the internet. An interview guide with questions related to the slaughtering of reindeer and meat quality was used, including a photobook. Interviews were recorded with video or sound recorder and transcribed. A photobook, inspired by Eira (2012), with pictures illustrating food culture, was helpful during interviews.

Secondly, historical sources about Sámi food culture were collected and analyzed. This include



Figure 2. Study area, Guovdageaidnu/Kautokeino, Northern Norway.

work by the Swedish humanist Johannes Schefferus (1673/1956), the Swedish botanist, zoologist, and physician Carl Linnaeus (1732/1995), the Danish teacher, astrophysicist, and photographer Sophus Tromholt (1885/2007), the Christian missionary Knud Leem (1768), the first Sámi author, Johan Turi (1910/2010), the Danish ethnographer and author Emilie Demant-Hatt (1913), and the ethnographer Ørnulv Vorren (1946, 1951, 1962). The written literature has been complemented by other historical sources, such as old pictures, former laws and regulations on animal welfare and slaughtering, and newspapers.

Thirdly, in reindeer husbandry, language is the basis for knowledge about the livelihood (Benjaminson et al., 2016; Burgess et al., 2018), and is a tool for communication (Eira, 2012). During discussions with Sámi reindeer herders, many concepts in the Northern Sámi language were mentioned. There is an advanced and systematic knowledge of meat quality, fat degree, fat content, and fat extent that is expressed by concepts in the Sámi language (R. B. M. E. Sara & Eira, 2020). The Sámi concepts were analyzed according to Eira's model (2012) and are presented in Table 1. The interviewees presented the definitions of the concepts, as a supplement to those given in the comprehensive dictionary of the North Sámi language compiled by the linguist Konrad Nielsen (1979), and provided a rich source for the historical use of concepts relating to reindeer husbandry.

Finally, the pH in the indicator muscle sirloin, *longissimus dorsi*, was measured according to Wiklund et al. (2001) by using the pH instrument Hanna HI98163 with the electrode FC232D. Eight female reindeer without a calf, *rotnu*, were slaughtered in February 2020 ($n = 8$). Four reindeer were used for control purposes (K6, K7, K8, and K9) and four reindeer for the *baggat* experiment (B2, B3, B4, and B 5) (Table 1). The *control* reindeer were immediately skinned and eviscerated after being euthanized, while in the experimental group (*baggat*), the skin was left on the carcass and the rumen was left inside for 3 hr after euthanasia. In both groups, the reindeer's esophagi were tied after euthanasia. Immediately after euthanasia, the pH level was measured inside the sirloin, *longissimus dorsi*, by inserting the pH probe connected to a muscle knife. The pH measurements were recorded

by the authors, subsequently for more than 3 hr on each reindeer. Air temperature was measured and ranged between -10 and -20°C during the experiments.

This research was conducted in accordance with *Ethical guidelines for handling traditional knowledge* (International Centre for Reindeer Husbandry [ICR], 2006), and the project was also approved by the Norwegian Centre for Research Data (NSD). pH measuring was done in cooperation with Sámi reindeer herders during their slaughtering.

Results

Sámi Reindeer Herders as Knowledge Holders

The Sámi traditional way of slaughtering is on the ground, *dieváš njuovvat* (Table 1, Fig. 3), when slaughtering a reindeer as food for the family, *niesteboazu* (Table 1, Figs. 3 and 4). There are two categories of slaughtered reindeer carcasses: *gorut* and *rumbu* (Table 1, Figs. 3 and 4). When slaughtering as a *gorut* (Table 1), the legs are cut from the hamstrings and the skin is removed. Furthermore, the head is removed, but the neck remains on the carcass. This technique is used when the meat is intended for commercial purposes. On a *rumbu* carcass (Table 1), the legs are cut from steak and shoulder. *Rumbu* is a reindeer carcass partly dissected, where intestines and rumen are removed, but the skin is only halfway removed from the carcass. The head, neck, legs, and hooves of the reindeer are packed inside the carcass and the skin is tightened. This method keeps the meat warm, in particular in winter, tenderizes it, and ensures hygienic conditions during transportation. (reindeer herders B and C)

When slaughtering a *niesteboazu*, it is still common today to leave the carcass inside the skin a while before butchering. It is left for at least 1 hr before the removal of rumen and skin because this makes the meat tender, *dipmat* (Table 1). This is a deliberate action by the reindeer herder to tenderize the meat as part of the slaughtering process. (reindeer herder E) The active process is called *bakka-hit* (Table 1) (reindeer herders A, B, C). After the death of the reindeer, the rumen fills with gas and the result of this process is called *baggan* (a linguistic inflectional form of the verb *baggat*). As a



Figure 3. Several reindeer euthanized and left to *baggat*. (A) Reindeer herder from Guovdageaidnu/Kautokeino, Northern Norway in 1970s, photographer unknown, photograph used with permission from Nils Isak Eira. (B) A *baggat* reindeer slaughtered by a reindeer herder from Eastern Finnmark, Northern Norway in 1960, picture by Ørnulv Vorren (1962). (C) Reindeer left to *baggat* before butchering in the winter, picture by Svein D. Mathiesen (2016). (D) Reindeer being skinned after *baggat* by a reindeer herder from Guovdageaidnu/Kautokeino, Northern Norway, picture by Svein D. Mathiesen (2016).

consequence of the process of *bakkahit*, the meat tenderizes. All types of reindeer, in particular animals such as castrates and older females, must *baggat* longer since they have tougher meat. (reindeer herders B and C)

According to reindeer herder C, reindeer meat becomes tough, *garra biergu*, and difficult to eat after cooking if the reindeer is skinned immediately after being euthanized, “*dan dihte ii šatta nu mievkkis dat biergu . . .*” (Authors translation: “Therefore reindeer meat does not become tender.”) Furthermore, she said that meat from *baggat* reindeer needs less cooking. By leaving the carcass with skin for a while and the rumen inside, the reindeer meat does not freeze so quickly, and instead becomes tender. (reindeer herder C)

Before cooking, reindeer herder touches the meat with fingers to assess the level of tenderness:

Usually when I start to cook the spine, it only needs to simmer for a very short time. If you cook it too long, the meat will fall off the bones. . . . On the other hand, if you start cooking the meat after slaughtering, the meat is so tough that you can never cook it enough. (reindeer herder A; authors’ translation from Northern Sámi to English)

In reindeer herder B’s experience, skinning the carcass is easier if the reindeer has been *baggat* at least for 30 min. If a reindeer is *baggat* too long, then the fat separates from the meat and sticks to the skin. Using the *baggat* method, the meat separates from the subcutaneous fat, becomes more liquid, and dissolves in the broth when cooked: “*biergu luoitá eambo vuoja go vuoššá*” (authors’ translation: “The meat loosens fat, and the fat becomes more liquid when cooked”) (reindeer herder B).



Figure 4. A reindeer slaughtered as *rumbu*. (E) Carcass is packed inside the skin. (F) Different parts are placed inside the carcass before transportation. Picture by Ravdna Biret Marja E. Sara (2020).

Reindeer meat from reindeer not exposed to the *baggat* method would have to cook much longer to become soft and edible. It is not dangerous to eat meat from a reindeer that has *baggat* too long. The reindeer herder has to know when and where to let the air out of the rumen, to avoid contamination of the reindeer meat by the rumen contents. (reindeer herder B)

According to reindeer herder D, reindeer herders always leave a reindeer to tenderize when slaughtering in the traditional way, but when they are slaughtering for sale and have euthanized several reindeer, there is no time to *oruhit* the carcasses for 1 hr. With *oruhit*, reindeer herder C means that after being euthanized, the reindeer is left for exactly 1 hr with its rumen and intestines inside to tenderize the meat (reindeer herder D).

Reindeer herder F argues that the method of euthanizing a reindeer influences the quality of reindeer

meat. If euthanizing is done in the traditional fashion, the reindeer must lie down to bleed out, and then the rumen is removed 10–15 min after skinning. When reindeer herders have plenty of time in the mountains, they leave the carcass with the rumen inside, which influences the meat. The process breaks down the meat so you can eat it fresh, on the same day, without the meat being leathery. When slaughtering in winter in -30°C , the herder leaves the skin on the carcass so it does not freeze (reindeer herder F).

Reindeer herders report several advantages using the traditional *baggat* method when slaughtering. Not only does it tenderize the meat, it also makes skinning easier because the carcass underneath the skin has dried. When skinning immediately after euthanizing, the carcass is wet, and skinning is heavier and reindeer hair will easily stick to the wet carcass. Reindeer herders are careful to clean the hair from the meat and place the meat on branches of birch or willow to avoid contamination from the ground (reindeer herders B and C).

Historical Perspectives on Reindeer Meat

The first written documentation of knowledge about reindeer meat consistency is from 1674 and explains that female reindeer without a calf, *rotnu* (Table 1), become exceedingly succulent if they are fattened until autumn, at which time the Sámi reindeer herders usually slaughter them (Schefferus, 1673/1956, p. 356). Furthermore, in 1732 Linnaeus wrote, during his travel to Sápmi, that reindeer were slaughtered before the rut, and hung up to be blown and frozen to their skins (Linnaeus, 1732/1995, p. 112). Leem documented a variety of concepts related to meat consistency (1768). In 1885, Tromholt (1885/2007) described that, after a reindeer was killed by a knife stabbed into its heart, the carcass was left to cool down before the skin was removed.

Turi (1910/2010) wrote that the Sámi used everything from slaughtered reindeer for their own use, and the blood was collected in the stomach that was washed with some water or depth hoar snow. The meat and intestines were packed inside the reindeer skin for transportation (Turi, 1910/2010). In Northern Sámi communities, *málle-čoaivi* (rumen, rumen content, and blood) was common food for humans and dogs, as explained by Demant-Hatt (1913).

In 1951, Vorren reported that if the slaughtered reindeer was likely to be particularly tough, the Sámi often did what they had seen the bear did in the old times, leaving the abdomen untouched without the rumen removed. After a day or so, the meat would be very tender, albeit slightly bitter (1951).

In 1959, regulation on reindeer slaughterhouses and reindeer meat control (Norwegian Ministry of Agriculture, 1959) stated that the digestive tract should be removed as soon as possible and no later than one hour after the animal's death, and that it should be removed from a hanging carcass. The reindeer administration inspector in Finnmark reported in 1962 that reindeer slaughter practices and post-slaughter treatment had gradually begun to move in a correct, sanitary direction. A large part of the credit for the increased quality of the reindeer meat, and the fact that *bush slaughtering* (slaughtering on the ground from a Norwegian perspective) had decreased. This could be attributed to the modern reindeer slaughterhouses in the county. In the most comprehensive work on Sámi reindeer husbandry by Norwegian veterinary expert, Skjenneberg and Slagsvold (1968) described how many reindeer herders slaughter properly for their own use. In the case of larger, commercial reindeer slaughtering, helpers are hired to slaughter, in which case more simple treatment of reindeer meat is seen. This type of slaughtering is also known as *bush slaughtering* and is a severe hindrance to reindeer meat achieving a high quality and price. They also observed that when Sámi reindeer herders slaughter for themselves, the stomach is inflated and the intestines are left in the carcass for a while to make the meat tender, and the authors remarked that this is understandable. (Skjenneberg & Slagsvold, 1968)

Photographic Documentation

Photographic historical documentation of Sámi traditional slaughtering methods and preparation of food is shown in Figures 1, 3, and 4. Furthermore, Figure 1 shows a Sámi reindeer herder in his traditional tent (*lávvu*) cooking reindeer meat over the fire, preparing food for the family, resulting in meat of unique quality. A comparative collage of traditional slaughtering demonstrating the *baggat* procedure is shown in Figure 3, where photos A and B show historical traditional methods from

1950 to 1970 and photos C and D show present traditional methods from 2016, *dieváš njuovvat* (Table 1). Figure 4 shows a reindeer carcass slaughtered as *rumbu* and packed inside skin for tenderizing, transportation and hygienic purposes.

Food Authorities as Knowledge Holders

In the 1950s and early 1960s, the supply of *baggan* and *rumbu* reindeer meat (*dieváš njuovvat*) (Table 1) from the remote grazing areas in Finnmark were sold to meat buyers along the coast. Mainstream Norwegian society and newspapers described this type of slaughtering in negative terms. It was described using the pejorative Norwegian term *buskslakt*, (bush slaughtering) (“Forferdelige spor” [“Terrible signs”], 1967). According to a previous county veterinarian in Troms and Finnmark, previous vice-minister and minister, the reindeer meat control was in a small shed in the city of Hammerfest in the 1950s. According to him, the meat controller at the coast of Northern Norway was not friendly towards the nomadic Sámi reindeer herders when they delivered their meat. In general, he described the relationship as directly discrimination. The Sámi way of slaughtering the reindeer was called bush slaughtering where the ground was the slaughtering bench and the rumen was removed from the carcass on the ground. (Veterinarian 1)

According to a senior food safety veterinarian in Northern Norway, the rumen should be removed from the carcass within 30 min, because the bacteria might enter the meat. Furthermore, the carcass should be hung before freezing to continue the tenderizing process in the meat. (Veterinarian 2; Skjenneberg, n.d.)

pH as a Meat Quality Measurement

The authors measured intramuscular pH in the sirloin, *longissimus dorsi*, immediately after death and it varied between 7.03 and 6.44 ($n=8$) in air temperature between -10 and -20°C . Three hours after slaughtering the control animals, the authors measured intramuscular pH in the sirloin, *longissimus dorsi*, and the pH varied between 6.47 and 6.23 ($n=4$). After 3 hr of *baggat* method, the authors measured intramuscular pH in the sirloin, *longissimus dorsi*, that varied between 5.74 and 5.6 (Fig. 5).

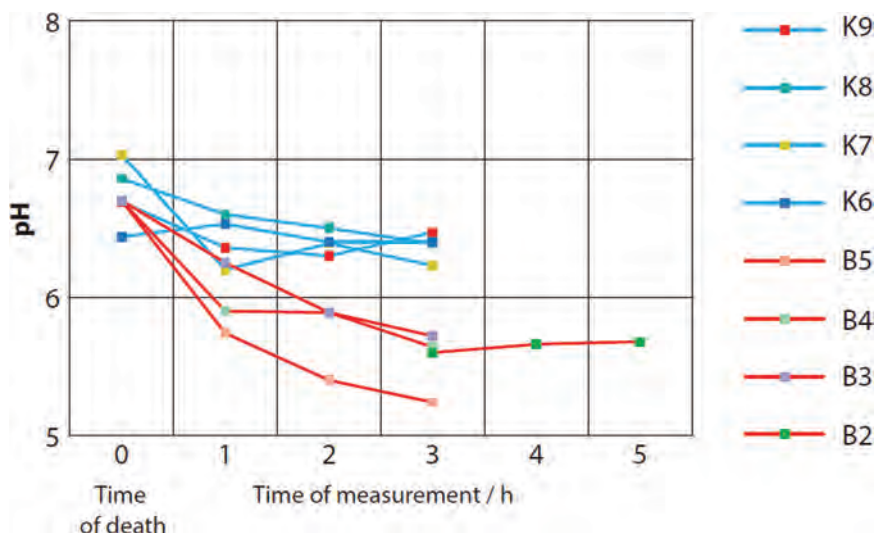


Figure 5. Levels of intramuscular pH in reindeer sirloin, *longissimus dorsi*, in eight reindeer carcasses. Four control (blue) reindeer were eviscerated immediately after euthanizing and four reindeer are *baggan* (red).

Discussion

Tenderness and Traditional Knowledge

Recently, Burgess et al. (2018), in collaboration with scholars representing seven indigenous peoples in the Arctic Council, defined Arctic Food Sovereignty as follows:

Our understanding of food security is that it must be based on Arctic Indigenous Peoples' equitable access and possibilities to select our own resources, food empowerment through the utilization of our own knowledge, the sustainable use of all resources in accordance with our traditional food systems, food safety regimes adapted to Arctic realities and Indigenous cultures, health and well-being, and local economic development and value-added from within our own societies. In short, a full and meaningful enactment of Arctic food sovereignty. (p. 17)

While Alaskan Inuit have their own knowledge system for food sovereignty (Inuit Circumpolar Council-Alaska, 2015, 2018), the Sámi food sovereignty is barely discussed in the Norwegian part of Sápmi. Kvitberg (2019) discussed how food functions as a rehabilitation in the everyday silent struggle of Sámi women to have control over “consumption of food harvested direct from nature” (p. 225).

For example, the Sámi traditional knowledge in concepts like *dievás njuovvat*, *baggat*, *garra biergu*, *niesteboazu* (Table 1) are poorly recognized in mainstream food knowledge systems in Norway. “*Garra biergu*” is the Sámi expression describing reindeer meat from cold shortening, which means tough meat. Without applying the traditional Sámi method when slaughtering reindeer in cold temperatures, muscles quickly chill and cold shortening of meat occurs (Wiklund et al., 2014). Shortening of muscles in domestic animals is noticed when prerigor muscles are subjected to a temperature of below 10°C, which makes the meat very tough and occurs due to extreme contraction (Bender, 1992; Cross & Singh, 2020). Sámi traditional knowledge used to avoid cold shortening of muscles in reindeer carcass could therefore be the *baggat* method and *rumbu* (Table 1).

In Alaska, Sámi reindeer husbandry from Norway was introduced more than 100 years ago in an extremely cold environment. To avoid cold shortening of reindeer meat, electrical stimulation was used in field slaughtering to tenderize the meat (Wiklund et al., 2014). Wiklund et al. (2014) concluded that reindeer carcasses cool too quickly in such harsh environments (Wiklund et al., 2014). Despite the fact that reindeer meat is naturally extremely tender (Wiklund et al., 1997), cold air temperatures

affect its consistency when slaughtering occurs outdoors. The use of industrial methods developed for domestic animals in outdoor slaughtering of reindeer indicates that the Alaskan practice of reindeer slaughtering did not include Sámi traditional knowledge. The significance of not using the Sámi traditional knowledge for tenderization is potentially lack of this knowledge and therefore lack of heritagization of traditional reindeer products.

The *baggat* method (Table 1) is a deliberate way to avoid cold shortening and tenderize the meat in cold air temperatures and is a form of traditional handling. Before the modernization of Sámi reindeer husbandry in Guovdageaidnu/Kautokeino, in the 1950s, the only slaughtering method was “*dievás njuovvat*” (Table 1). Old reindeer must be *baggat* for at least 1 hr, and younger reindeer only a few minutes. If the reindeer is *baggat* too long, the rumen can explode and contaminate the meat (M. N. Sara, 2013). However, Soriano et al. (2016) found that in wild red deer in Spain, an evisceration time of 4 hr produced more odor but had less effect on the meat quality.

Today this old traditional practice, as documented in the literature back to 1732 (Linnaeus, 1732/1995), is in conflict with industrial slaughtering in Norway (Norwegian Ministry of Agriculture, 1977), while “the Sámi worldview continues to influence the herders’ understanding of the relationship between humans, reindeer and nature” (Johnsen, 2018, p. xi).

The Even reindeer herder from Russia explained that in Even food culture, tender meat depends on the types of reindeer slaughtered. *Mangai*, a non-productive female, has more tender meat in general and takes less time to cook. Castrates have tougher meat and are cooked for longer. (reindeer herder H) The Sámi also prefer a nonproductive female, *rotnu*, as food (Table 1). In contrast to Sámi customs, Even reindeer herders remove the skin from the carcass immediately in cold temperatures (reindeer herder H), while the Dolgan reindeer herders in Russia wait 1 hr before skinning the reindeer after euthanizing because it is easier to remove the skin and the meat is more tender (reindeer herder I).

Results indicate that Sámi traditional knowledge for tenderizing reindeer meat is a part of the everyday, practical preparation of food for the family at home. Therefore, this article argues that the

traditional knowledge of Sámi reindeer herders about meat consistency supports the need for future Sámi food sovereignty, recognizing the rich knowledge base and self-sufficiency of the untapped resources in the Arctic (Burgess et al., 2018, p. 25). This article argues the Sámi traditional knowledge should be included in future hygiene certification of reindeer meat.

Hygiene and Traditional Knowledge

Today, Norwegian food hygiene regulations recommend removal of rumen and its content immediately after euthanizing the reindeer, to maintain good meat quality and avoid contamination of meat (Norwegian regulations on animal hygiene, 2009; Skjenneberg, n.d.).

In the 1960s, when industrial slaughtering was not fully developed in Northern Norway, Skjenneberg and Slagsvold (1968) observed that reindeer were left lying for hours before butchering. If the rumen and intestines were not removed immediately, fermentation and bacteria growth began in the rumen. Therefore, bacteria had good access to the meat through the bloodstream and had good conditions for multiplying and reducing the quality of the meat (Skjenneberg & Slagsvold, 1968).

Norwegian meat cooperatives had established modern slaughterhouses along the coast of Northern Norway in the 1950s (Norwegian Ministry of Agriculture, 1977), while negative accounts of dirty, unhygienic meat and inhumane slaughtering conditions in Sámi reindeer husbandry in the mountains dominated the newspapers (“Forferdelige spor” [“Terrible signs”], 1967). A conflict between official practices in modern slaughterhouses and reindeer herders’ traditional practices became visible (Paine, 1994).

The basic pH level for all kinds of meat is between 5.5 and 5.7, measured 24 hr postslaughter. Values over 5.8 will have reduced shelf life (Wiklund et al., 2019). The pH level of the reindeer meat measured in this study after *baggat* was a level, which in the modern meat industry is regarded as hygienically optimal for tenderization and preservation of fresh meat. The pH level after *baggat* might inhibit bacterial growth, and call for further investigation.

Furthermore, when Sámi reindeer herders slaughter on snow, it is a clean process. Reindeer herder C

explained how the Norwegians made up the unhygienic concept *bush slaughtering*, meaning that the reindeer is not slaughtered in a slaughterhouse. A reindeer herder would never slaughter in such a way that the carcass is contaminated. Nevertheless, bush slaughtered reindeer was used as an argument by the Norwegian meat cooperatives to slaughter the reindeer industrially. (reindeer herder C) Veterinarian 1 expressed that the meat-controlling personnel at the coast were unfriendly and discriminating towards Sámi reindeer herders. Therefore, maintaining reindeer herders' practices and traditional knowledge on slaughtering was difficult, not allowing development of a special certification system based on Sámi reindeer herders' knowledge.

Recently, Bernardo and Rodrigues (2020) demonstrated "how the certification process of food souvenirs can entail an intense symbolic power conflict between different producers with economic implications that segregates key stakeholders and threatens to crystallize the cultural dynamic of food production, innovation, and reinvention" (p. 129). It is likely to assume that the early certification system of reindeer meat did not favor Sámi food heritage. In late 1950s, the Norwegian food policy favored Norwegian branding of reindeer products, such as *surra reinstek* (a stocking with reindeer meat marmorised with pork fat) (Norsk rikskringkasting AS [NRK], 1967) not prioritizing Sámi reindeer products such as *baggan* reindeer meat, blood sausages, and hooves (Burgess et al., 2018). *Surra reinstek* is not common in Sámi reindeer herders' food culture. Kaiser (2020) recommends learning from indigenous food cultures to produce more ethical and sustainable food. Sámi traditional knowledge on food hygiene and gastronomy could therefore strengthen Sámi food sovereignty and food governance in the future.

Gut Content and Traditional Knowledge

The polar explorer Fridtjof Nansen (1891) reported that the Inuit peoples of Greenland ate the rumen contents of the caribou in the absence of a plant-based diet in winter, and this was considered a delicacy, especially if pieces of seal blubber and berries were added.

Hauptmann et al. (2020) support Nansen's report by concluding "the caribou rumen is a rich

source of microbes that has traditionally been ingested and which has previously been shown to contain by-products of microbial fermentation that have been associated with positive health impact" (p. 12). Research on the stomach ecosystems of isolated indigenous peoples in Africa and Latin America shows the dominance of the microbe *Prevotella* in their stomachs (Hauptmann, 2020). Scientific articles (Bello et al., 2018; De Filippo et al., 2010; Smits et al., 2017) discussed the importance of gut microbiota for health and well-being. "Gut microbial richness could have several health-related effects" (De Filippo et al., 2010, p. 14694). Greenlandic Inuit, who have traditionally eaten very little plants and fiber got *Prevotella* from the caribou. Several indigenous peoples in Circumpolar North had independently concluded to include reindeer rumen content in their diet (Burgess et al., 2018). This is a strong argument against the danger in leaving the rumen inside the carcass before butchering.

For example, Nenets reindeer herders in Russia eat raw meat and preserve reindeer meat in the reindeer stomach. This is called *sorak* or *sydy* in Nenets language (personal communication with Nechei Serotetto) (Fig. 6). The stomach is emptied, partly rinsed, and some blood is poured in with the meat, lungs, liver, vertebrae, and a little salt. Usually this is then frozen, and pieces are cut off to be used, but in summer it is preserved by fermentation (reindeer herder G), which seems to be similar to Northern Sámi *málle-čoavji* (Table 1). The stomach is turned inside out, cleaned in snow, and blood is added. In the winter, the stomach is only cleaned with snow, as are the intestines that are used for blood sausages. Rumen and intestines content have therefore always been part of the Sámi food knowledge system, the importance of which has not yet been completely understood.

Conclusion

Sámi food products, like *dipma biergu* (soft meat) from *baggan* reindeer (Table 1), comprise a unique quality based on Sámi traditional knowledge using a secure system for tenderization. This is one example of how to strengthen reindeer herder's traditional knowledge, food sovereignty and improve the sustainable economy of reindeer husbandry.



Figure 6. Nenets reindeer herders preparing a reindeer rumen for fermentation with blood, meat and fat. Picture by Svein D. Mathiesen.

The tourism industry in Sápmi seems not to be developed in favor of Sámi food heritage, with high-quality and delicate food, *hersko* (Table 1) (Nielsen, 1979). In contrast, mainstream Norwegian industrial food seems to dominate the tourism industry with typical Norwegian brands. Gastronomy is a key element in tourism, especially with destinations related to culture and heritage as well as the landscape that provides the food from nature. Gastronomy involves the transfer of knowledge and information about the people, culture, landscape, traditions, and identity of the place visited (Jimenez-Beltran et al., 2016). “Terroir food” has special qualities or a uniqueness that can be linked to a particular place or region (Bele et al., 2017, p. 234).

In the Sámi language, reindeer herders do not use the concept of “gastronomy.” Indicators of food quality, such as tenderness and fat content in reindeer meat, are important to express qualities of Sámi gastronomy and for future Sámi food sovereignty. A growing interest in indigenous food

culture (Yang et al., 2020) has resulted in more Sámi products and tourism companies (Kramvig & Førde, 2020). The challenge of bringing everyday, practical food knowledge of Sámi cooking into gastronomy and tourism has hitherto not been solved.

The lack of certification of home-made products from reindeer could be the main reason for why tourists rarely eat Sámi food when they visit Sápmi. The prerequisites for Sámi families preparing tender reindeer meat at home are the use of the whole animal, the traditional knowledge, high-quality food resources, and cooking methods defined as *Sámi gastronomy* (Fig. 1). Recently, Arctic Council supported “establishment of Arctic standards of indigenous food production, based on food security and safety, but adjusted to Arctic indigenous cultures, food practices and traditional knowledge” (Burgess et al., 2018, p. 26). Arctic food governance must therefore adjust to better accommodate Sámi traditional knowledge and family-based food in certification of reindeer meat products to conciliate the different way of knowing.

Acknowledgments

Research Council of Norway supports this article by the project “Rapid change—challenges and/or opportunities for Sustainable reindeer husbandry project? (Rievdan),” project No. 238326, by Sámi University of Applied Sciences and International Centre for Reindeer Husbandry. We are very grateful for the knowledge holders from Norway and Russia who participated in this study. We acknowledge Iulie Aslaksen, Issat Turi, Kia Krarup Hansen, Inger Marie Gaup Eira, Anders Oskal, Karen Lykke Syse, Aviaja Lyberth Hauptmann, Nellejet Zorgdrager, Elna Sara, Nechei Serotetto, Gunnlaug Ballovarre, Anne Katja Gaup, and Nils Isak Eira for help and comments.

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