

# Mother Cultures

## *Skyr Microbes, Dairy Maids and Super Women*

Valdimar Tr. Hafstein, Jón Þór Pétursson and Viggó Þór Marteinsson

**Abstract:** This article explores long-standing symbiotic relations between women and microbes in Iceland while analysing the transformation of this relationship in the making of the dairy product skyr during the twentieth and twenty-first centuries. In the past, differences in microbial cultures and production methods meant that the taste and texture of skyr varied greatly. Standardisation and technological innovations have steadily impoverished its microbial diversity over the past 120 years. Starting from a historical account of skyr making, we zoom in on skyr in the twenty-first century, a period in which skyr has had an international breakthrough, captured in branding efforts and advertising campaigns produced in this decade for various types of skyr from producers in Iceland, Europe and the United States.

**Keywords:** foodways, gender, microbes, skyr, symbiotic practices

A buoy floats in the sea against the background of snowy mountains. A light comes on in a solitary house on the coast. Inside the house, we see a woman named Hildur, who has just woken up and is preparing for her daily swim in the sea. Before diving into the cold ocean, she needs a hearty breakfast: Arla skyr. These are scenes from Arla's German skyr ad. "This is our old family tradition, the morning swim", the narrator tells us while also explaining that skyr is fat free and rich in protein. Hildur then dives from the dock and swims "to the buoy and back", precisely as her mother did before her every morning. Hildur's daughter, dressed in a traditional Icelandic wool sweater, watches her mother with admiration from the kitchen window. Swimming in the cold sea, the narrator continues, is something that Hildur would like to pass on to the next generation. The ad closes with a shot of three generations: Hildur and her daughter, while Hildur holds a photo of her mother on the dock coming up from the sea after swimming "to the buoy and back" (Arla Deutschland 2017).



Arla is a multinational dairy company based in Sweden and Denmark, but it sells its products in Europe and beyond – it is the fourth-largest dairy company in the world, and this is just one of its many skyr ads featuring strong Icelandic women, lots of wool, and Arla skyr. On the global skyr market, Arla has several competitors. One of them is Icelandic: the biggest producer of skyr in Iceland is MS Iceland Dairies, competing for market share internationally but with a much smaller advertising budget.

In 2017, MS Iceland Dairies began promoting a new brand of skyr to better distinguish its product on the global dairy shelf: Ísey skyr. The company's advertisements introduce Ísey as a beautiful Icelandic female name; the name refers both to ice (*ís*) and to the island (*ey*), referencing Iceland itself in the guise of a woman. The lids of plastic skyr buckets sold in supermarkets across Europe assure consumers that “Ísey Skyr is a remarkable dairy product unique to Iceland” (a claim apparently undermined by the small print on the side of the bucket that denotes the country of origin as Denmark – much like that of Arla's skyr). And under the heading “The Ísey Skyr Story” on the MS Dairies website, one can read about the historical and cultural role of skyr through the centuries:

Once upon a time, 1,100 years ago in fact, Nordic settlers began arriving in Iceland. They brought with them the skills and knowledge for producing skyr. As time passed, the know-how and recipe for this nutritious food slowly faded out elsewhere in the Nordic region. Luckily, the Icelandic skyr making tradition continued.

For centuries, Icelandic skyr formed a cornerstone of the national diet, helping to keep people strong in living conditions that were often harsh. On family farms countrywide, it was the women who nurtured this dairy and passing on [*sic*] both the recipe and the original Icelandic skyr cultures from mother to daughter. (Ísey Skyr n.d.)

Skyr is thus anchored in the past, the know-how and recipe handed down from one generation to the next for centuries, even millennia, from mother to daughter, as the advertising explains. Historically, the dairy was indeed a domain of female authority and female labour. Thanks to geographical isolation, the tradition of skyr making was safeguarded in Iceland in contrast to other countries in Northern Europe, in which it may once have been quotidian but is now a long-lost art. In other words, this is a story of cultural resilience – in more ways than one, for skyr making depends not only on the survival of cultural tradition but no less so on the resilience of traditional microbial cultures. The opening formula of “The Ísey Skyr Story” quoted above suggests that the survival of skyr is a sort of modern fairy tale: “once upon a time.” If that is so, the skyr microbiome plays the protagonist role and Icelandic women that of fairy godmother.

The tale begins when the microbes leave home and set sail for Iceland along with their human companions.

Skyr is a thick and sour dairy product that is produced by heating skimmed milk before cooling it down again. The next step is to add live fermentative microbial cultures, which effectively make the skyr by curdling the milk. Outside of Iceland, skyr is often referred to as a thick yoghurt, but technically it is an acid-curd cheese (to call it yoghurt is one of the surest ways to offend Icelanders, many of whom take great pride in the uniqueness of this creamy dairy product). In this article, we ask: (1) what is the long-standing symbiotic relation between women and microbes? and (2) how has this relationship been transformed during the twentieth and twenty-first centuries? We thus focus on changing relationships between microbes, gender and health through the lens of skyr production and consumption over the past one hundred years, adding a microbial perspective to the study of traditional foodways – a classic subject of European ethnology – a historical and cultural perspective to food microbiology and the emerging interdisciplinary field of ethnomicrobiology (Tamang 2022) and an empirical contribution to the growing scholarship on more-than-human relations (Haraway 2007; Lorimer 2020; Tsing 2015; Sayes 2014; Barad 2003; Whatmore 2002).

The article outlines the historical trajectory of skyr and describes the practice of skyr making as it evolved in the nineteenth and through the twentieth century, relying on archival sources. These sources were collected from timarit.is, an online archive of all printed newspapers, journals and magazines published in Iceland from the nineteenth century until the present day, with a short embargo period and a review of the literature. They are combined with oral history from our eight interviews, two periods of participant observation and two field visits with dairy farmers, dairy scientists and marketing staff conducted in Iceland in the years 2009 to 2023 (the majority between 2018 and 2023). Taking advantage of our different disciplinary backgrounds and methodologies, as ethnologists and biologists, we combine these classical ethnological sources with biosamples of skyr microbiomes of various origins, analysed using modern molecular techniques such as gene sequencing and protein mass spectrometry.<sup>1</sup>

The article closes by zooming in on skyr in the twenty-first century, a period in which skyr has had an international breakthrough after being an ever-present and unremarkable part of the Icelandic diet for a millennium. Its breakthrough is partly captured in branding efforts and advertising campaigns produced this past decade for various types of skyr from producers in Iceland, Europe and the United States. We analyse these branding efforts and advertising campaigns, such as the ones that open this article, to better understand the symbiotic relationship between women and microbes and how this relationship has morphed

through societal changes and technological innovations over the past hundred years. In the concluding section we draw together our argument, highlighting two illuminating inversions brought about through the industrialisation of skyr making and its global marketing. The online archives of YouTube help access these sources, but print advertisements are found on other sites online; these are complemented by the websites of various large dairy companies that produce and market skyr, as well as by our own consumption of skyr in Sweden, France, Belgium, Switzerland, the UK, the US and Iceland.

## Original Cultures

As far as available evidence goes, the making of skyr did not develop much from the age of Iceland's settlement in the 800s until the beginning of the twentieth century (Gísladóttir 1999). Milking was women's work and so was the production of butter, skyr and whey from the milk. When the milk settled in its containers, the cream floated to the top. Once it was skimmed off, the cream was churned into butter – the best way to conserve it. Butter was currency; according to eighteenth-century sources, it could be preserved for over 20 years (Halldórsson 1973; Ólafsson and Pálsson 1975). In addition to contributing labour, tenant farmers often paid rent in butter; landowners would collect – and eat – the butter; it could be exchanged for other goods; and merchants' and labourers' wages could even be paid in butter. Accounts from the late sixteenth century of the diocese of Hólar, a major landholder in the north of Iceland, show that the bishop owned a mountain of butter weighing up to forty tons, much of it rent for church-owned lands (Tómasson 2016: 119–121).

It takes one litre of cream to churn half a kilogram of butter; but one needs ten litres of milk to skim that one litre of cream off the top. That leaves nine litres of skimmed milk as a by-product of butter. When making skyr, women would (often but not always) begin by heating the skimmed milk. This was pre-Pasteurian dairying, so the goal in heating was not to kill unwanted microbes but rather to make the skyr smooth and grainless (heating “denatures” the proteins, which helps the microbial fermentation bind them together later in the process). They would then allow it to cool down again before adding a pinch of skyr from the previous batch, which contained the live skyr cultures. In English, this is known as “backslopping” and is common practice in the fermentation of milk all over the world, where people “use old batches of whey or yoghurt to inoculate a new production with a stable and safe microbial community” (Reichhardt et al. 2021: 345). Such a pinch of skyr contained various species of fermentative bacteria and yeasts and served as an inoculum from previous, successful skyr making. For the best outcome, it was important to inoculate the new batch of skyr with a healthy balanced microbiome. These

cultures set to work in the skimmed milk, beginning a fermentative process that led to acidification, by which milk becomes skyr; the bacteria and yeast fed on lactose, producing lactic acid as a waste product. The lactic acid inhibited the growth of microbes that might otherwise spoil the milk. In many cases, skyr makers also added rennet, an enzymatic agent to facilitate coagulation (usually a piece of a newly slaughtered calf's or lamb's stomach), which helped the skyr thicken and settle into its ready, semi-solid state. Finally, after it had cooled down again, the skyr-makers strained the skyr through cloth using one of a variety of different traditional straining devices. This last step separated the whey from the skyr. Every cup of skyr leaves roughly three cups of whey as a by-product. Indeed, the name refers to this separation; "skyr" is related to the Icelandic verb "skera", to cut or divide, which in turn is a close relative of modern English "shear".

Each household made its own skyr, producing and conserving the live cultures needed to make the dairy product. To make a new batch of skyr it was necessary to preserve a bit of skyr from the previous batch. Skyr was mostly a seasonal food made during summertime, especially in connection with the weaning of lambs (and calves), which traditionally took place near the end of June. This meant that women often had to borrow microbial cultures (that is to say, a pinch of old skyr) from a neighbouring household that had managed to preserve the cultures the whole year, or else make them again from fresh milk (Pétursdóttir 1960: 14). The resilience and adaptation of the skyr microbiome, its natural and cultural selection, and the constant introduction of new bacteria and yeast fostered great microbial diversity. Indeed, bacteriologist Sigurður Pétursson, who conducted the first microbiological studies of skyr in the 1930s, noted that "[s]kyr making literally is the breeding of certain bacterial species and therefore a complicated task" (Pétursson 1939: 143).

The live microbial cultures of traditional skyr and their reproduction in the dairy provide a prime example of symbiosis between microbial cultures and human cultures or, to put it differently, of species interaction between microbes and humans: collaborative cultural practices. Indeed, in the past two decades we have learned to understand the human organism as a "composite of many species" (Paxson 2008: 38–39). The numbers vary a bit, but by all accounts, "we" are outnumbered; that is, less than half of our bodies' cells are human (ca. 1:1.3). The majority of our bodies' cells consist of a multitude of microbial species with whom we co-exist in the most intimate ways imaginable, co-consuming and co-producing (Sender et al. 2016a, 2016b).

Certain microbes, including those in skyr, have played a key role over millennia in the development of humans' ability to digest milk in adulthood (Rosenstock et al. 2021). Known as lactase persistence, this ability is historically related to pastoral agriculture and is today strongest and most widespread

among northern European populations (Gerbault et al. 2011). However, recent studies indicate that it was still relatively rare in Europe as late as the Bronze Age (3000–1000 BCE), suggesting that it developed only in the last 3000 years (Allentoft et al. 2015). Lactase persistence is thus a textbook case of how microbes have shaped not only human culture but also the human gut, highlighting human–microbe hybridity (Ingram 2011) and the ways that microbes have co-evolved with human culture and human genes. Edwin Sayes (2014: 144) notes that “nonhumans do not have agency by themselves, if only because they are never by themselves”, but of course the same may be said of humans. Agency between humans and non-humans – skyr microbes included – is thus best described as relational (Whatmore 2002: 4; Barad 2003).

Historical and archaeological records attest to the consumption of skyr in the first centuries after Iceland’s settlement in the ninth century CE, accounting for more than a third (and perhaps more) of the period in which lactase persistence may have evolved. What is perhaps most interesting about traditional skyr making is that there seems to have been no standardised way of doing it, no more than there were standard skyr microbes. There were important regional differences in producing and sustaining the microbial cultures, both in terms of ingredients and methods, and even skyr-making equipment could differ from one household to the next (Gísladóttir 1999). In the same way that multiple variants of a legend or a fairy tale attest to its popularity at the time of collection, we argue that the great variety of skyr can be explained by its essential role in the traditional Icelandic diet. Since many different households made skyr, skyr inevitably came in different forms. This diversity testifies to the crucial role that skyr played in the Icelandic diet in previous centuries, and the role that skyr microbes played in Iceland as a companion species to the human population.

Differences in microbial cultures, production methods and equipment also meant that the taste and texture of skyr varied between regions and even households. Not only that, but skyr was made from whatever milk was available, which, in keeping with the livestock, was most usually sheep’s milk, often cow’s milk and more rarely goat’s milk. This much we can learn from otherwise scarce historical records (Gísladóttir 1999; Pétursdóttir 1960; Halldórsson 1973). The taste and texture of skyr was determined to a large extent by the kind of microbial flora that became dominant in the milk when it curdled; this depended in turn on the composition (how skimmed it was and from what animal), on the microbial flora of the milk used, on the flora in the previous batch transferred to the new one, and on the rennet, as well as on the microbial ecology of containers and instruments. In addition to the microbiome, variation in each step of the production process made for a variety of different outcomes; for instance, whether the milk was heated and, if so, for how long and to what temperature; the process for cooling the milk afterwards and the speed at which

it cooled down; as well as the implements used for straining the skyr and how much it was strained. Before the age of inexpensive thermometers and reliable timepieces, women determined the temperature and time intervals using their thermal and temporal senses, trained by working in the dairy alongside other women and cultivated through years of experience, but subject of course to variation between different women and different households. Thus, while it was always recognisable as skyr, the product's qualities varied widely between households, between regions and over time. The microbial cultures themselves have certainly evolved over the course of the millennium of skyr making in Iceland (Valsdóttir and Sveinsson 2011; Pétursdóttir 1960: 15; Gísladóttir 1999).

In the 1920s, the first Icelandic dairy farmers' cooperatives were created in response to a growing domestic market in urban areas. The number of milk producers had been on the rise from the beginning of the twentieth century (Gröndal 1985: 7–10; *Tíminn* 1973: 10–11). However, the development of the dairy industry faced various obstacles: inefficiency, competition between farms and uneven hygiene in the small units of production and the chain of distribution. Concerns about diminishing revenues for dairy farmers' cooperatives prompted the Icelandic government in 1934 to pass legislation to regulate milk production and distribution. Although the issue was both political and economic, one of the principal arguments revolved around hygiene standards and the need to pasteurise milk centrally before selling to consumers, a topic hotly debated in parliament before a majority voted to require it by law (Einarsson 1965: 25–70; Gröndal 1985: 18–19; Guðmundsson 2005: 24–34).

These were the early days of the industrial production of skyr, but gradually it transformed the process and the products. Responsible for this modernising process was a new profession: dairy scientists. As the industrial and technological know-how was limited in Iceland at that time, Danish dairy scientists had to be imported to the country (which had just obtained political sovereignty from Denmark in 1918) (Guðmundsson 2005: 19–20). Science was still a foreign agent and the Danish dairy scientists, who were all male, did not themselves have the traditional know-how to make skyr. To compensate, Icelandic women were asked to teach Danish dairy scientists basic skyr-making skills. The Danes were soon replaced by Icelandic dairy scientists, all of them educated in Copenhagen and all of them men.

The logic of mass production quickly favoured cow's milk over that of sheep and goats as cows are easier to confine – thanks to their docile disposition – and give a far higher milk yield per animal. In the same period, lamb meat acquired greater market value; as a result, the practice of weaning was abandoned, and lambs were allowed to feed on ewe's milk until they were slaughtered in autumn (Júlíusson 2013: 130–131). Hence, the dairies only produced skyr from cow's milk, quickly replacing sheep skyr as the dominant variety and eventually doing



away with it altogether as industrial production replaced production at home. Other than that, skyr making at the dairies initially closely resembled the traditional mode of production on Icelandic farms through previous centuries, only the scale was larger. Little by little, however, the dairy scientists broke away from tradition and skyr making began to change.

Recent results on the microbial diversity in skyr confirm this change. Unpublished research from microbiologists (including one of the authors of this article) and food scientists at Matís OHF (the Icelandic Food Research Organisation) on the cultivated microbial communities from skyr with different origins is unequivocal in this regard. Samples were taken from three different sources: from two small farms in Iceland that had kept the old tradition of passing on the mother skyr culture to the next batch of skyr for an unknown number of years and from skyr produced at industrial scale. The study revealed a large difference in the microbial numbers and diversity between the farm skyr cultures and the industrial ones. The farm skyr in both cases showed much higher numbers of cells and contained similar isolated species and strains of bacteria and yeasts, while the isolates from the industrial skyr were far fewer and contained homogenic bacterial isolates of *Streptococcus thermophilus*. In contrast, both traditional farm skyr cultures contained not only *Streptococcus thermophilus* but also *Lactobacillus bulgaricus* and two yeast species, *Kluyveromyces marxianus* and *Saccharomyces cerevisiae* (Valsdóttir et al. 2011). These findings are consistent with previous results from Pétursson (1939).

Moreover, the bacterial and yeast species isolated from the skyr from both farms showed significant differences on a strain level.<sup>2</sup> In contrast to the diversity among the skyr strains from the two farms, *Streptococcus thermophilus* isolates from the industrial skyr were identical. These recent results confirm previous research on traditional skyr cultures, although further research is needed to estimate how important the role of different species and strains is in skyr making and in obtaining the characteristics of the final product.

### Skill and Subordination

There is another way to tell this story – one that does not just refer to hygiene, industry, economy and science in a narrative of progress and productivity. That narrative obscures an essential part of the story: the gender of its protagonists. As noted above, milking was women's work and the dairy a traditional domain of female authority and skilled labour. An account from the turn of the twentieth century tells of a mayor in a rural municipality who cried from shame when his son milked the cows for his wife who was pregnant with their twelfth child (Sigurðardóttir 1985: 248). In a book-length treatment of the history of women's work in Iceland, Anna Sigurðardóttir remarks that it was not until well into the



twentieth century that men in Iceland no longer found it disgraceful to milk a cow. With a note of sarcasm, she adds that soon thereafter milking machines were introduced to all larger farms (ibid.).

Prior to the twentieth century, the dairy was often at a remote location by the summer pastures, sometimes at considerable distance from the farm. The dairy was populated exclusively by women with the exception of one shepherd, usually a teenage boy. Sheep, goats and cows were milked at the dairy, where the dairywomen also filtered the milk, skimmed the milk of its cream, churned the cream, kneaded the butter, curdled the skyr and separated the whey. It was hard work, and the hours were long, from the early hours of the morning until late at night. But it was also skilled work, requiring a great deal of know-how that belonged exclusively to women. The mistress of the farm directed the work, or a housekeeper on her behalf, and most tasks in the dairy required ingenuity, skill and sensitivity of all the women who worked there – an ability to anticipate and infer how food would taste from “how things look, feel to the hand, smell (outside the mouth), and sound” and by tasting the “food at a distance by activating the sense memories of taste and smell” (Kirshenblatt-Gimblett 1999: 3). Thus, to churn the butter and curdle the skyr, the milk had to be heated to a particular temperature, which the mistress or housekeeper determined with her finger; to the trained ear the sound from the churn revealed how far churning had progressed and when the butter was ready for kneading (Sigurðardóttir 1985: 250).

As historian Deborah Valenze remarks in an article on women’s work and the dairy industry in England in the eighteenth and nineteenth centuries, the “dairy presented a world of labour unto itself, topsy-turvy in its assignments of gender roles”, where “the workforce, headed by a woman, was primarily female” (Valenze 1991: 158); she adds that “the qualities assigned to women and men in the dairy virtually inverted the roles of the sexes: women combined decision-making with industry, and showed ceaseless commitment to a never-ending workday, while men appeared on the scene only sporadically to contribute unskilled labour” (ibid.: 160). With the late arrival of industrial capitalism, the same held true for the dairy in Iceland until after the First World War.

An early phase of the rationalisation of dairy work in Iceland involved the creation of creameries at the turn of the twentieth century. They collected cream from farms in their district to churn butter for sale in towns and villages; the skimmed milk was either left behind at the farms or returned to them after separation at the creamery. If the establishment of creameries marked the formal entry of butter into the market economy (and out of the feudal economy of rent extraction), skyr remained for the time being a part of subsistence farming. The creameries were directed by creamery keepers (*rjómabússtýra*), who had

all received a formal five-month education in dairying, and each one employed several creamery assistants, who had trained for two-and-a-half months at the same institution, the Dairy School founded by the Agricultural Society of Iceland in the summer of 1900 and directed by the Dane Hans Grönfeldt (Ívarsson and Lýðsson 2005: 11–13). The creameries offered the only independent employment outside the home available to women at the time. These jobs were better paid than domestic work and farm labour, and they were in great demand. Like the remote farm dairies, the creameries were led by women and offered positions of responsibility, requiring knowledge and skills (ibid.: 13–14; Sigurðardóttir 1981: 257–264).

The age of the creameries did not last long, however. In the 1920s and 1930s, they were disbanded one by one, and the very last one closed in 1952 (reopening as a creamery museum in 1975) (Ívarsson and Lýðsson 2005: 51–58). From the 1920s onwards, the creameries were replaced by the new industrial dairies. One feature united them: an inversion of the previous gender relations in the dairy. The managers who ran the dairies were all men and next in the pecking order of the industrial dairies were the dairy scientists, also men. Dairywomen were subordinate and contributed what increasingly came to be viewed as unskilled labour, which was gradually replaced by machines. A similar development was sweeping over Europe at the time, for example in Bulgaria, where “housewives relinquished yogurt making to male workers in small dairies” (Stoilova 2013: 73). As scientific discourses and capitalist economy infiltrated the dairy, the new industrial production of dairy “displaced women from valued positions and relegated them to a more vulnerable place in a system that purported to be value-free” (Valenze 1991: 169). With the economy of scale provided by large dairies with labour-saving machinery, “authority came from above and the autonomy of women was clearly circumscribed” (ibid.: 166). The result was the same in twentieth-century Iceland as Deborah Valenze (ibid.) describes a century earlier in England: “Machinery gradually performed much of the [dairy]maid’s actual work, while leaving a less skilled person in charge of supervising each task. At the bottom of the hierarchy, the ordinary dairymaid became part of the proletariat of the agricultural workforce.”

Prominent mid-twentieth-century women’s rights advocate Hólmfríður Pétursdóttir sums this displacement up in a coda to her own detailed description and history of traditional skyr making, published in a magazine for women’s rights in 1960:

Icelandic skyr making is a heritage from past generations of Icelandic women, women who through ingenuity, rational observation and diligence made skyr into the quality food it has been, thus contributing to maintaining the fitness and resilience of the Icelandic race in past centuries. Now Icelandic women have handed this heritage over. It would be more correct to say, however, that

economic and social transformations have seized it from them. Hopefully the nation will have the good fortune to keep preserving it in centuries yet to come. (Pétursdóttir 1960: 17)

### **New Skyr: Time and Standards**

As the dairy industry gained momentum from the 1920s onwards, home production of skyr declined. Home production of dairy food such as skyr and butter was time-consuming and the depopulation of rural areas after the turn of the twentieth century left less labour available for such tasks. The dairy co-operatives solved the dilemma for farmers; they could produce these products in more economic and efficient ways in more densely populated areas. New production methods and declining home production of skyr meant that differences in taste and texture, between farms and regions, diminished steadily throughout the twentieth century.

The modernisation of skyr making followed the general transformation of the dairy industry all over Europe (Stoilova 2013). The dairy scientists at the industrial dairies – as agents of modernity – had two principal concerns: time and standards. Modernising the making of skyr meant rendering the production process more efficient to produce greater quantities in less time, but also to extend the product's shelf life. The most time-consuming aspect of making skyr was the straining. Many of the technological innovations throughout the twentieth century aimed at accelerating that process. In 1942, one of the largest dairy farmers' cooperatives (Mjólkurbú Flóamanna) introduced a new centrifugal straining technology to replace the various cloth-straining frames; this sped up the straining process by a whole day and freed up time previously spent on cleaning the frames (*Tíminn* 1973: 10–11). A further step in this same direction was taken in 1965–1968, when two of the biggest dairy cooperatives (MS Dairies and Mjólkurbú Flóamanna) experimented with the use of a new mechanical centrifuge to separate the whey from the curd, which was even more cost- and time-effective but also made the texture of the finished product softer and more uniform. In 1968, moreover, the cooperatives began to pasteurise the skyr, to select the bacteria and yeast that went into it and manage the microbial variation. This innovation meant that skyr could last 5–7 days in a refrigerator before acquiring a sour taste. The product became known at the time as “the new skyr” (*Tíminn* 1968).

Moreover, the innovations sought to standardise the production process, creating in each batch of skyr a product that resembled the last batch, minimising variations in texture and taste. For that purpose, it proved necessary to standardise both the milk and the live microbial cultures used to make skyr. Much of the research conducted by the Icelandic dairy scientists who followed the Danish ones has served this purpose (Guðmundsson and Kristbergsson 2016).

A major innovation in 1968 involved the packaging of “the new skyr” in 500-gram plastic containers as a pre-packaged consumer good (milk only began to be sold in cartons three years earlier) (Guðmundsson and Kristbergsson 2016). Up until this point, skyr had been sold over the counter by weight (and milk by volume) in the dairy monopoly stores, scooped up from a barrel, cut into slices and packed in parchment (to be stirred up at home with milk, cream or whey, as well as sugar). With deregulation of dairy distribution in the 1970s both the barrels and the new containers moved into grocery stores. Plastic eventually prevailed; the last skyr was scooped up into brown paper and weighed on the grocery store scale sometime in the 1980s. Among other effects, pre-packaging skyr under sterilised conditions in the dairy eliminated the introduction of an environmental microbiome at the point of retail, further regimenting the product’s microflora and standardising its taste.

*Vísir*, one of Iceland’s principal newspapers at the time, dedicated its “Women’s Page” on 28 February 1969 to skyr debates, noting that the “new skyr” had been “much discussed recently” and “criticised a great deal”. Four specialists, all men, discussed its merits, a bacteriologist, a dairy manager, a veterinarian and a public food safety supervisor:

We have now sought information from four men well-versed in these matters and asked them to respond to a few questions about the new skyr ... its proportion of dry matter and bacterial contents, the methods of production and the health benefits. We also asked whether they considered it plausible that it entailed the extinction of the Icelandic art of skyr making as it has been practised here through the centuries. (Nýja skyrið 1969: 5)

The bacteriologist, Sigurður Pétursson, responded that the bacterial flora still had quite a bit of variation and that the methods of production were more convenient and far more hygienic but “no less Icelandic”. As for the health benefits: “As long as part of the skyr bacteria stay alive, I believe this skyr is just as healthy as the old one.” The manager of the Mjólkurbú Flóamanna dairy cooperative, Grétar Símonarson, noted that the bacterial content was “certainly very different and far smaller”. The cooperative’s veterinarian, Guðbrandur Hlíðar, claimed, however, that the most important bacteria were in the new skyr, along with the yeast, whereas “the old skyr contains innumerable bacteria that it is hard to research and account for”. As for the Icelandic art of skyr making, the veterinarian pointed out that the bacterial composition of the new skyr was determined by an Icelandic dairy scientist, Sævar Magnússon, who had studied Icelandic skyr; for the veterinarian, this was guarantee enough of the quality of the new production method. The journalist for the “Women’s Page” closed by noting that “as those who have tasted these two types of skyr already know,

there is some difference in the taste, and people hold very different opinions as to which tastes better” (Nýja skyrið 1969: 5).

It was a matter of taste and perspective. From the microbiome perspective, the difference was vast. The long species interaction of skyr microbiome and humans, reaching back before Iceland’s settlement, possibly as far back as the end of the Bronze Age, was cut short by these innovations. A mutually symbiotic relationship between companion species, lasting more than a millennium and based in reciprocity, was replaced by a parasitic relationship, where one organism uses the other to its own advantage and the other’s detriment. The innovation of “new skyr” and the gradual abandonment of “old skyr” made in the traditional way was nothing less than a catastrophe for the skyr microbiome with calamitous results for variation.

At the beginning of the twenty-first century, home production of skyr and other dairy products had disappeared almost completely in Iceland (Valsdóttir and Sveinsson 2011). The latter half of the twentieth century saw the merger of many of the local dairy cooperatives, resulting in bigger and more efficient regional units that further advanced standardisation and reduced variation. These mergers finally culminated in the creation in 2006 of MS Iceland Dairies, which established a near complete monopoly over dairy production (see Pétursson and Hafstein 2022).

In a parallel development, a new brand of skyr launched in 2000 – Skyr.is – became the flagship of the skyr production of the MS Iceland Dairies monopoly, sidelining other varieties or pushing them off the market. In the new streamlined production process for Skyr.is, an ultrafiltration process replaced centrifugal straining for separating the curds from the whey. This was partly a matter of efficiency, for ultrafiltration cuts the time needed for separation nearly in half so that it is done within a day.

The most important difference from the microbial perspective, however, had neither to do with the packaging nor the protein, nor with the texture or the taste. In producing Skyr.is, the food engineers at MS Iceland Dairies took a final step towards the full standardisation of the skyr production process by eliminating entirely the transmission of live microbial cultures from one batch of skyr to the next. The traditional method of backslopping – using a pinch of old skyr to produce new skyr – was now dropped in preference for ready-made, single-use packages of purchased freeze-dried bacterial cultures produced in an industrial chemical laboratory setting. These are stirred into the skimmed milk following its pasteurisation, only to suffer a second pasteurisation of the skyr once the cultures have helped to make it. This second pasteurisation doubles (again) the shelf-life of the final product; the Pasteurian agenda of microbe suppression is here more concerned with retail than with hygiene.

The logic guiding standardisation in this case is not least that of risk management, as a product developer at MS Iceland Dairies, Björn Sigurður Gunnarsson, explained in our interview: “There is too much at stake, too much risk with all the amount of milk used” to leave skyr-making to the caprice of live mother cultures from the last batch of skyr (interview with Björn Sigurður Gunnarsson 2019). Instead, MS Iceland Dairies relies on freeze-dried cultures from selected strains that are cloned (and hence always identical) abroad by Danish bioscience company Chr. Hansen, a global supplier of food cultures, probiotics and enzymes (*ibid.*). This, of course, is a fundamental break with tradition, but entirely in keeping with contemporary practice in commercial dairy production, which prefers isolated bacterial strains, whereas traditional heirloom cultures are complex communities of bacteria and yeasts that have evolved together and have a structure to them that guarantees their resilience and consistency over time even as they allow for variation (Gatti et al. 2014; Rest 2021; Kasper 2013). With this latest innovation, skyr finally became an entirely standardised dairy product, one that always tastes, smells, looks and feels the same.

### Symbiotic Conclusion

In 2017, this perfectly standardised product – Skyr.is – was rebranded as Ísey Skyr. In its marketing abroad, Ísey Skyr is cast as a “new dairy from a timeless tradition”:

A traditional favourite of Icelanders, Ísey Skyr is the only skyr that contains the original Icelandic skyr cultures from MS Iceland Dairies, and it’s made according to the original Icelandic recipe. (Ísey Export n.d.)

The lid of the plastic container of Ísey Skyr we bought at a local supermarket in the south of France tells consumers, “It’s made with the original Icelandic skyr cultures, which help give our top quality skyr its delicious taste and texture”, before encouraging them to “Taste the difference”. Indeed, “Original Icelandic Skyr Cultures” is a registered trademark owned by MS Dairies, as is “The Original Icelandic Recipe”, featured next to the brand name Ísey on the packaging, with an Icelandic flag between them. In the United States, MS Dairies has partnered with an American venture capital investment firm, Polaris Founders Capital, to create Icelandic Provisions, a company that sells “Traditional Icelandic Skyr”, as the label says. Its advertising claims that the “reason nothing else tastes like Icelandic Provisions” is that it uses “Certified Icelandic Heirloom Skyr Cultures”:

These cultures have been treasured and preserved in Iceland for hundreds of years. In the same way that sourdough starters are passed down through families

and shared between neighbors, the women of Iceland have passed this tradition on through generations to provide the cultures in your cup of Icelandic Provisions. (Icelandic Provisions 2019)

The use of “Original Skyr Cultures”, we learn, makes this “the only authentic Icelandic Skyr in the US market”.

The majority of skyr advertisements – whether from MS Dairies in Iceland, Icelandic Provisions in the USA or European competitors such as Arla – highlight skyr making as women’s heritage, passed from mother to daughter for a millennium or more. It was the women who safeguarded traditional knowledge to produce skyr as well as the genetic resources – the right composition of the fermented microbial communities – needed to sustain continuous skyr making. These ads typically reference Icelandic nature and strong Icelandic women, often wearing wool sweaters. Remember Hildur’s morning swim to the buoy and back, from the opening vignette of this article, with references to her mother and daughter? Another Arla TV ad features a gainly Icelandic woman in a wood cabin with rugged mountains in the background. Wearing a traditional wool sweater, she looks up from her jar of skyr to ask Dutch viewers (in Icelandic with Dutch subtitles): “What is this?” She explains that skyr is nothing new, that it has been around for a thousand years. It is neither yoghurt nor quark, she adds, emphasising the uniqueness of Icelandic skyr. Without further ado, she then gets up, steps outside and sets to work cleaving wood with a large axe as the Dutch narrator’s voiceover introduces this fat-free, protein-rich superfood (Arla Skyr 2015).<sup>3</sup> Behind her is a big pile of split logs; it’s been a busy week. The message of strength, vigour and woman power could hardly be less oblique.

While MS Dairies has a much smaller advertising budget, its ads are equally gendered and dominated by similar visual motifs. It is apparent from these various advertisements that the chief target consumer group for skyr are women who recognise themselves in the ads: radiating health and happiness, they couple strength with beauty. It is well established that women consume more so-called superfoods than men (Franco Lucas et al. 2021; Kirsch et al. 2022; Siró et al. 2008) and “superfood advertorials are overwhelmingly targeted to women” (Sikka 2017: 93). From dairy maids to superwomen, the marketing thus instrumentalises mother cultures in more than one sense of the term.

To conclude, we are witness to a double inversion in the transformation of skyr from traditional food to contemporary commodity. The first inversion involves gender. As previously noted, MS Iceland Dairies is the corporate heir to the various dairy farmers’ cooperatives founded in the first half of the twentieth century. Their industrial dairies moved dairying out of a female domain and into a male social and economic order (that of industrial capitalism), led by male managers and scientists, subordinating women in the dairy and re-interpreting their contribution as unskilled labour. Denigration of women’s



work and deprecation of its value are thus an integral part of the heritage on which MS Iceland Dairies is founded. In its branding and marketing of skyr, however, that heritage is turned inside out as the role of women in skyr making through the centuries is narrated and celebrated. We suggest that this selective storytelling gives itself away in the way that its historical reference to women as producers of skyr in fact envisages women as consumers of it.

The second inversion involves microbes. Up until the twentieth century, skyr making fostered and relied on microbial diversity within species, which in turn fostered diversity in the taste and texture of skyr. It was made in different environments (themselves with various fermentative microbiomes), with different methods and equipment, different types of milk and varied bacterial flora in old batches of skyr that were used as an inoculum to start new batches. De-localisation (as households stopped making their own skyr), standardisation, hygiene regulation and technological innovations in the twentieth and twenty-first centuries greatly impoverished the microbial diversity on a strain level in skyr making. This is clearly revealed in the unpublished results presented previously on the cultivated microbial communities in skyr with different origins. Ultimately, the skyr-making process was transformed by doing entirely away with the transmission of live cultures from one batch of skyr to the next. Once this transmission had been replaced with industrially produced, single-use, isolated bacterial strains, the story of these live cultures and their transmission between the generations became central to the branding of Icelandic skyr.

The inversions complement one another. In the move from the most local source of sustenance in subsistence farming, produced and consumed on the farm, to global dairy stardom, export and advertising, women as producers of skyr have thus been reimagined as women who consume skyr: as a market niche for a naturally fat-free superfood. At the same time, in the same move, the skyr cultures themselves are rebranded as “original and authentic” through their stabilisation, cloning, freeze-drying and, ultimately, pasteurisation. There is a consistent and perverted logic at play here, culminating in the heritage branding of the same symbiotic relationship between women and skyr cultures to which it has effectively put an end.

**Valdimar Tr. Hafstein** is Professor of Folklore, Ethnology and Museum Studies at the University of Iceland and leads the interdisciplinary project “Symbiosis: Human-Microbial Relations in Everyday Life”, funded by a grant of excellence from the Icelandic Research Fund. Valdimar is the author of two books in English, *Making Intangible Heritage: El Condor Pasa and Other Stories from UNESCO* (Indiana University Press, 2018) and *Patrimonialities: Heritage vs: Property* (Cambridge University Press, 2020, co-authored with Martin Skrydstrup), and one in Icelandic on bathing culture, *Sund* (Forlagið, 2023, co-authored with Katrín Snorradóttir). He has skyr for breakfast most mornings, sometimes with fresh blueberries. <https://orcid.org/0000-0001-6375-4166>

**Jón Þór Pétursson** is a postdoctoral researcher at the University of Iceland. Jón Þór has published various articles and book chapters on food and foodways, cultural heritage, emotions and consumption. He is currently focusing on human–microbial relations, biocultural heritage and symbiotic practices. <https://orcid.org/0000-0002-7102-470X>

**Viggó Þór Marteinsson** is Professor of Microbiology at the Faculty of Food Science and Nutrition, University of Iceland and a research group leader in the Department of Research and Innovation, Matís Iceland. Viggó’s study of microorganisms ranges from the deep sea to the air and space, from hot springs and lava fields to glaciers, and includes analyses of human and animal health by looking at their gut flora. His work not only investigates how microbes live in different, sometimes extreme, environments, but also how they can be used to create new and improved foods. <https://orcid.org/0000-0001-8340-821X>

## Notes

1. Our study of skyr is one part of a larger collaborative project funded by the Icelandic Research Council that investigates “Skyr as Biocultural Heritage: Ethnographic and Biological Study of Live Cultures, Resilience, and Diversity” (Grant no. 2410337-051).
2. This diversity was observed with 16S rRNA (Marteinsson et al. 2010) and 18S rRNA (Castillo-Castillo et al. 2016) genes sequencing of the bacteria and yeast respectively. MaldiTof Biotyper (Bruker MALDI Biotyper®) analysis based on protein mass spectrometry and Pule Field Gel Electrophoresis (PFGE) was also used for strain distinctions. In addition, we have performed whole genome sequencing of the strains.
3. The reference to wood cleaving is an interesting one as Iceland is known for its lack of trees and therefore has no tradition of warming up houses with wood.

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