

Fermentology • Fermentology

The Safety of Fermented Foods

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Editors note: *This publication contains the video of the talk from the Fermentology webinar series, as well as a lightly edited transcript of the lecture.*

Abstract

Cheesemaking is an ancient means of preserving milk. But is cheese made from raw milk inherently riskier than cheese made from pasteurized milk? Heather Paxson will take us through the cultural history and practical implications of U.S. food safety regulation of cheese, which since 1949 has been predicated on a binary distinction between pasteurization and its absence. By bringing into view the artisan techniques of cheesemaking that can accomplish food safety on a par with (or may even exceed) pasteurization, she reframes cheese safety as a matter of holistic practice, not merely “clean” inputs. She will also reflect on the role and challenge of classification — how best to sort a limitless variety of cheese types into meaningful categories — for safety regulators, producers, retailers and consumers alike.

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Watch the talk

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The Safety of Fermented Foods: Raw-milk vs. Pasteurized Cheese(s) with Heather Paxton

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Introduction

Cheese, as a fermented food, is alive with bacteria, yeasts, and molds, whose metabolic activity, breaking down sugars and proteins and milk, generates the aromas, flavors, and textures that we recognize as cheese. It can also, if rarely, harbor pathogens responsible for food-borne illness. In the US, cheese safety is primarily promoted through routine pasteurization of the milk used to make it. Cheese made from unpasteurized milk is a regulatory exception.

The History of Pasteurization + the US

To be sold in the US, cheese must either be made from pasteurized milk or be aged for a minimum of 60 days at a temperature no less than 1.7 degrees centigrade. The “60 day rule” dates to World War II, when an overseas outbreak of typhoid was traced to a batch of contaminated unpasteurized cheddar. A subsequent lab study found that aging cheddar made from raw milk proved sufficient after 60 days to knock out *Salmonella typhimurium*. The premise of the 60 day aging rule is that as a cheese, such as cheddar, ages or matures, it dries out and becomes more acidic — sharper, we might say. And, thus, as a microbial environment, it grows increasingly inhospitable to pathogenic germs, such as salmonella, that could be introduced to milk through insanitary dairying.

For 70 years, US safety standards have been guided by a binary distinction between cheese made from pasteurized milk, and cheese made from raw (unpasteurized) milk. But today, the 60 day rule, put in place in 1949 at the height of the industry's industrialization, is becoming obsolete, outmoded on the one hand by the emerging and growing awareness of new pathogens of concern, particularly toxigenic *E. coli* and *listeria monocytogenes*, which behave differently than salmonella. And on the other, by a surge of artisan cheesemakers keen to work with raw milk, and customers eager to consume it as cheese.

Given growing consumer interest in fermented foods, civic support for artisan agriculture, and anti-big government sentiment, a total ban on raw milk cheese is politically unlikely. Though some in the FDA would probably love nothing more. Still, the legal future of raw milk cheese has for decades been subject to on and off regulatory review, and remains far from certain.

The False Binary

As an anthropologist, I want to call attention to the role, and the challenge, of classification in food safety guidance and regulation. Promoting cheese safety through mandating either pasteurization or minimum aging creates a binary world of cheese made either from pasteurized or from raw milk, leading to binary, all-or-nothing thinking about quality and safety. Thus we hear that raw milk cheese is inherently dangerous, a public health disaster waiting to happen, and also, the most beautiful, most perfect food humans have ever known.

Even the very distinction of raw versus pasteurized milk imposes a binary on what's actually a continuum. By US legal definition: any milk that's not fully pasteurized,

heated at a set temperature for a set time to virtually kill off all microflora present, is classified as raw. What's labeled as raw milk cheese may actually be made from milk that's been subject to a gentler heat treatment, known as thermalization, or been pushed through microfiltration that effects a similar, near-total reduction in microbes. Future regulation to ensure the safety of raw milk cheese will need to overcome such binary thinking.

The History of Cheesemaking

To demonstrate why, let me start with a bit of history. First, let us agree that raw milk cheese is a modern invention — by which I mean the idea of raw milk cheese as a food category doesn't exist without its opposite, pasteurization. Up until 100 years ago, of course, all cheese was made with “raw” milk. It wasn't remarkable. It was just cheese.

For generations, cheesemaking was considered a domestic art. Farm women added rennet when heated milk felt warm to their touch. They drained curd from the watery whey when it had the right grip in their fingers, not when an acidimeter told them to. Quality was variable. And by the mid-19th century, cheesemaking's inconsistency came to be derided as unscientific and inefficient.

In the span of a single generation in this country, men took over cheese production through a regional factory system, pooling fresh milk from neighboring farms and scaling up methods that women had used in home kitchens. Consistency remained a problem until bacteria were discovered to be responsible for curdling. Once scientists learned to isolate and cultivate acidifying bacteria in the lab, pasteurization soon followed.

Pasteurization

Beginning in the 1930's, American cheese factories reformulated their recipes to work with pasteurized milk by reviving it with commercial “starter” cultures of lactic acid bacteria to kick-start fermentation. This innovation enabled cheesemakers to work with older milk that had traveled greater distances to the creamery. Pasteurization not only starts a cheese off with a microbially clean slate, it has the effect of slowing cheese ripening over time. Less microbial diversity means less metabolic activity, a slower creep towards rot, and a more standardized product.

In practical terms, then, the introduction of pasteurization had to do with consistency, standardization, and economies of scale: market concerns. In symbolic terms, pasteurization represented the techno-scientific control of nature for human ends,

making cheese an emblem of innovation and modern progress. By the 1950's, pasteurized milk cheese had become the unmarked category. I didn't grow up talking about “pasteurized cheese.” Now *it* was just cheese.

Among older artisan factories that resisted automation, some installed pasteurizers while others did not. But half a century ago, use of unpasteurized milk wasn't advertised as the gustatory or probiotic virtue it often is today. My point is that as a food category to be defended or challenged, “raw milk cheese” is meaningful in comparison to pasteurized counterparts. What it means culturally continues to take shape as the meaning of pasteurized cheese evolves.

In the middle of the 20th century, raw milk cheese looked to be obsolete. To food scientists for whom the anti-microbial benefits of pasteurization are incontrovertible, and who envision industrial-scale farming when they think of a milking parlor, making cheese from unpasteurized milk is an unnecessary risk. In their view, what I have called a *pasteurian* view, raw milk cheese is not merely a backwards holdover from a pre-pasteurian past, it's irrational. For pasteurians, pasteurization civilizes ruminant milk, making it safe, indeed appropriate for human consumption. And so for 70 years, safety standards have treated cheese made from raw milk as inherently, categorically different than pasteurized milk cheese.

Post-Pasteurian

Now, fast forward a generation to the artisan “renaissance.” Cheesemaking was returned to American farms in the 1970's and '80s by hippie homesteaders for whom handcrafted cheese represented a quintessentially “natural” food, valued not for its gourmet appeal but for its symbolic opposition to the bland homogenization of industrial foods epitomized by plastic wrapped slices of processed cheese food.

Against the hyper-hygienic pasteurian approach that regards nature as an unruly threat to be tamed, reducing the world of ambient microorganisms to potential pathogens, artisanal methods take a more environmentalist view of the nature of milk, welcoming a diversity of bacteria, yeast, and molds into cheesemaking as potential collaborators. I have called this artisanal approach, *post-pasteurian*. Post, in that it takes after pasteurianism in acknowledging pathogenic risk, and in taking hygiene seriously. But it also moves beyond an antiseptic attitude to cultivate “good” microbes and to enlist them as allies that might outcompete the “bad” ones through a process of competitive exclusion. To do so, post-pasteurians approach cheesemaking as a labor intensive practice of managing the microbial environment.

That environment begins with healthy animals and good hygiene in the milking parlor, continues as proper temperature and acidity control in the vat — and then scales down to a wheel of cheese itself, managed as a microbial environment by brushing the surface with salt brine, and controlling the ambient temperature and humidity in the aging room. This is not pre-modern. There is no magical thinking here. Successful post-pasteurians reserve the right to be scrupulous in what they do.

Legalized Cheese Safety

Now, we can begin to see the trouble with the reductive binary approach to cheese safety, relying on either pasteurization or aging, regardless of whether a cheese is made using industrial or artisanal methods, and regardless of whether we're talking cheddar, Camembert, or what have you. The trouble is that it obscures these other distinctions that also contribute to risk and safety. In reality, cheese safety and quality depend on the health of dairying animals, the hygiene of milk production, on the skill and care of cheesemakers, and on the ability of those good microbes to vanquish the undesirable — itself a feature of moisture content and acidity linked to recipe, as well as environmental conditions like temperature and humidity.

It's a problem that meaningful, contingent distinctions regarding process, skill, and care are not captured by regulatory, or even culinary cheese categories. Indeed, in generalizing from the microbial environment of cheddar, which loses moisture and gains acidity as it ages, the 60 day aging rule has set standards that permit the possibility that unsafe foods may enter the market.

Again, by US law, a cheesemaker may sell raw milk cheese, regardless of what type, only after it reaches an age of 60 days. However, contradicting the premise of the 60 day aging rule, aging a mold ripened cheese such as Brie or Camembert turns out to increase its pathogenic vulnerability. That's because, unlike cheddar, by 60 days its acidity actually declines. Of particular concern is *Listeria monocytogenes*, a bacterium that can cause listeriosis. Although rare, listeriosis has a 20% fatality rate, and accounts for roughly 1/4 of deaths attributed to foodborne illness in the US. *Listeria* is also partial to high moisture and low acidity.

Moreover, unlike *E. coli*, which originates in manure and can enter the milk supply through insanitary dairying, listeria is ubiquitous and likely to infect a cheese during manufacturing, aging, or packaging. Pasteurizing milk prior to cheese making is no barrier to this sort of contaminant. It's in the environment.

Although FDA officials never intended to establish the 60 day rule as an equivalent standard to pasteurization, that's how some consumers, and even a few short lived producers, unfortunately have come to view it. In 2017, an outbreak of listeriosis traced to legally aged, though improperly made raw milk cheese, hospitalized eight people, and resulted in two deaths. A clear problem with the 60 day rule for ensuring the safety of raw milk cheese is that not all cheeses behave like hard, dry sharp cheddar. And not all pathogens behave like salmonella.

Overestimating Pasteurization

But the broader problem, I'm suggesting, is absolutist thinking about pasteurization, and about microbes. If food scientists and regulators tend to overestimate the supremacy of pasteurization, others may overestimate the power of those good microbes to guarantee both quality and safety of fermented foods.

A few years ago, I discovered online print-on-demand t-shirts, bumper stickers, and even baby bibs, emblazoned with a smiling microbe and the slogan: "I'm a post-pasteurian." The website explained: "What is a post-pasteurian? A really smart person who understands that pasteurization kills all (yes, ALL) the good in food."

Now, in putting the beneficent nature supernaturally enlivened by microorganisms against a power greedy culture embodied by regulatory overreach, the view espoused here is *anti-*, not post-pasteurian — at least as I defined it in a 2008 article. Pasteurization does not kill all the good in food any more than it guarantees safety.

The trouble with food safety regulation is that it is based on classification that generalizes within type. As a microbial ecology, no less than as a food, raw milk cheese is not one thing. It is not all equally well-made, equally risky, or equally tasty. And our current typologies and regulatory categories cannot account for the contingencies that matter.