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UNIVERSITY OF WISCONSIN-MADISON

FRESH Seminar: “The Risk of Raw Dairy Product Consumption: Simple, Right?”

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MADISON, Wis. (FRI) – Raw milk is a contentious issue, as Dr. Poulsen observed first-hand at the now-infamous rally for raw milk in Eau Claire, WI on March 10, 2010. At that time (and still today), retail sale of raw milk in Wisconsin is illegal, although certain incidental sales are permitted. The 2010 bill to allow on-farm sale of raw milk in Wisconsin was eventually vetoed by then-Governor Doyle after being passed by the state legislature. The quest by some to legalize raw milk sales in Wisconsin continues, however, despite recent well-publicized *Campylobacter* outbreaks attributed to raw milk in Wisconsin at Racine in 2011 and Durand in 2014.

The definition of “retail sale” becomes murky in low- and middle-income countries such as Ecuador, where, for example, urban dairy goats are milked on-the-spot for thirsty customers. One major health concern associated with the sale of non-pasteurized milk to the general public in Ecuador (and the U.S. as well) is brucellosis. Poulsen discussed his work towards improving food safety in general in Ecuador through his efforts in controlling brucellosis within animals there.

Brucellosis is the most common zoonotic disease worldwide, with 500,000 human cases reported annually. This number is likely an underestimate because brucellosis, a chronic disease characterized by recurrent fever and joint pain, shares many symptoms with other diseases such as malaria, typhoid, and rheumatic fever. Bacteria of the causative *Brucella* species can infect cows, goats, sheep, and other animals and is transmitted to humans who consume raw milk from infected animals. *Brucella* is easily killed by pasteurization.

A massive U.S. *Brucella* eradication campaign begun during the middle of the last century reduced the annual number of human brucellosis cases from 6,247 (in 1947) to about 800. Many current cases occur in Hispanic populations living in states on the U.S.-Mexico border and are associated with consumption of raw-goat-milk-derived cheeses. The dramatic reduction in brucellosis cases in the U.S. is the result of vaccination along with test and slaughter programs. Wisconsin currently is classified by the USDA as Class Free, which means the disease has not been found in cattle in the state during the preceding 12 months. Having Class Free status eliminates mandatory vaccination and testing for cows within the state. However, cows entering the state must be vaccinated or tested “disease free” within 10 days of shipment.



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In addition to obvious public health benefits, the elimination of nearly all brucellosis in the U.S. also has yielded significant economic benefits. Losses from reduced milk yields, aborted cattle fetuses, and lower breeding efficiency have been reduced greatly: in 1952, these annual losses were estimated at \$400 million nationally (\$3.5 billion adjusted for inflation), compared to <\$1 million today. However, if brucellosis control efforts in the U.S. ceased today, production costs would be expected to climb within a decade by an estimated \$80 million dollars annually.

Successful disease control programs are difficult to implement and maintain. They are very expensive, and prioritization of efforts is difficult for countries with limited resources. Many of the locations with brucellosis concerns lack appropriate animal records and documentation systems. Obtaining government buy-in for control programs can be problematic as well. In the end, industry must also be willing to pay a premium for disease-free animals.

Mongolia and Greece both provide examples of brucellosis control programs that did not ultimately succeed. Mongolia's efforts from 2000–2002 were likely hindered because they did not include yaks and camels in the program, as these animals are often cohoused with cattle. Their program did not cover the entire country, excluding two provinces, and it focused on human testing. Additionally, Mongolia's efforts only considered one *Brucella* species, *Brucella melitensis*, while omitting *Brucella abortus*.

Greece's program was initially successful at reducing annual disease rates from 2.1 cases/10,000 individuals in 1975 to 0.25 cases/10,000 individuals in 1992. However, their strategy to control rather than eradicate the disease by only vaccinating replacement animals ultimately failed, as the disease resurged in 1998, prompting mass vaccinations.

These past experiences in brucellosis control set the stage for Dr. Poulsen's research and control program in Ecuador. Initial testing in Ecuador involved 2,561 cows, of which 7.2% were positive for the disease. Within goats, the prevalence was even higher at 17.8%. Disease prevalence was proportional to herd size, suggesting the more frequent influx of new animals associated with larger herds could increase disease rates. The realization that some infected animals sent for slaughter somehow ended up back at market is likely a significant contributor to the high disease prevalence.

Other challenges were identified. Currently, it is difficult to test milk effectively in Ecuador. Animal identification and record keeping needs to be improved. Vaccination of animals on farms was not correlated with disease prevalence, likely because of improper storage and handling of vaccines.

Improved vaccine efforts in Ecuador are now underway. Although the Ecuadorian government is becoming more active in controlling brucellosis, the demand for control is most effective when it comes from industry or the community rather than from government, as demonstrated by Temple Grandin's work to improve livestock handling methods in the U.S. Grandin's recommended measures, such as curved corrals, originally were promoted for reasons of animal welfare but were embraced and adopted by industry because they also improved production and efficiency.



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The role of government, industry, and citizens in the raw milk controversy in Wisconsin is also complex. Many of the consumers leading the drive for raw milk are educated people. Sometimes, however, they make uneducated choices.

In order for U.S. milk to be labeled “Grade A,” it must have no more than 750,000 somatic cells/mL prior to pasteurization, while in the EU, the limit is 400,000/mL. In addition, the standard plate count cannot exceed 100,000 CFU/mL to meet U.S. Grade A standards (although most creameries require an even more stringent count of <10,000 CFU/mL).

Bulk milk tanks typically are tested only once per month. However, this may not be adequate if the milk is to be sold raw. Healthy animals can shed pathogens in an unpredictable manner, as evidenced by a summer student project directed by Poulsen that found *Listeria monocytogenes* in one sample from two goat dairies (which had 10 and 70 goats) and STEC in two samples from two bovine dairies (with 200 and 75 cows).

In Poulsen’s discussions and observations of 29 small farms maintaining 2 to 30 cows or goats, he found 71% of farms sold the majority of their milk (>75%) as raw milk. The huge demand and higher price raw milk commands, the belief raw milk is healthier, and an anti-pasteurization bias are leading reasons farmers favor raw milk sales.

The methods used in producing raw milk are variable and can affect milk quality. Poulsen noted significant farm-to-farm variation in udder preparation (for example, not all farms used gloves when milking). A farm in Windsor, Colo. (where raw milk can be legally purchased by buying a “cow-share”) possibly represents the gold standard in raw milk production methods. The cows at this farm were initially purchased as TB-, *Brucella*-, BLV-, and MAP- negative animals. No grain is fed to the animals. Every batch of milk is tested for *Campylobacter*, *Listeria*, *Salmonella*, and STEC by PCR.

Poulsen commented it is challenging to get people to discuss their preference for raw milk. Some question why selling raw milk is not allowed when drinking raw milk historically has been common in Wisconsin. However, although many Wisconsinites grew up drinking raw milk, many of those who want to purchase raw milk did not, and their immune system may respond differently to potential pathogens as a result. Poulsen’s experience with the state legislature and others has led him to realize that talking in detail about the science behind the risks of raw milk is not useful. Instead, efforts could be better put elsewhere. Using stories to convey the message can be more effective than citing a laundry list of pathogens that could contaminate raw milk. Focusing on high risk groups (including children), and informing the public’s choices may be more beneficial towards helping consumers ultimately minimize their risks.



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The Food Research Institute (FRI), a part of the College of Agricultural and Life Sciences at the University of Wisconsin–Madison, operates its own laboratories and administers its own research and service programs. The mission of FRI is to catalyze multidisciplinary and collaborative research on microbial foodborne pathogens and toxins and to provide training, outreach and service to enhance the safety of the food supply. To fulfill this mission, FRI conducts fundamental and applied research, provides accurate and useful information and expertise, delivers quality education and training, and provides leadership in identifying and resolving food safety issues to meet community, government, and industry needs.

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