

Why Milk Quality and Food Safety Matter

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If you followed Fonterra's recent botulism scare in the news, you have had an insight into the importance of milk quality and food safety. For those who didn't follow the story, on August 2, three batches (equalling 38 tonnes) of whey protein concentrate produced in May 2012 tested positive for *Clostridium botulinum* - the bacteria that can cause botulism.

C. botulinum is a Gram negative, anaerobic, spore forming bacteria. The spores are resistant to heat treatments that kill bacteria. When the spores germinate they produce a toxin that blocks nerve function and can cause blurred vision, slurred speech, dry mouth and in the worst cases, paralysis, respiratory failure and death. Infants are particularly susceptible to botulism as their digestive tracts are not as acidic as those of adults and they have not yet developed a "good" bacteria population to control invasives.

The whey protein concentrate that tested positive was used in many products, including beverages, food supplements and infant formula. Fonterra immediately notified regulators and voluntarily recalled an estimated \$15 million worth of product to prevent any consumer harm. Investigation at the milk plant showed that a "very little used piece of pipework was not as sanitary as it should be." (3) The line was cleaned and subsequent product tests were negative for *C. botulinum*. Despite their quick action, China, Vietnam and Russia banned the imports of Fonterra's milk powder and whey proteins. Consumer confidence was eroded and world milk prices swung wildly.

By August 28, further testing had revealed that the initial results were incorrect, the actual bacteria in the powder was *Clostridium sporogenes*. *C. sporogenes*, while related to *C. botulinum* does not produce the botulism toxin and represents no food safety concern, but has been linked to food spoilage. The initial relief that the product did not represent a health hazard (food safety) was short lived as concerns turned to the process failures that led to contamination with a bacteria causing food spoilage (milk quality) - almost equally important to customers and consumers.

While this episode of milk contamination is believed to have originated at the plant, it easily could have arisen at the farm and been brought in with the raw milk. It serves as an example of exactly how milk safety and quality can hugely impact - with one positive bacteria test - world market prices and the reputation of a company and of milk. There are conditions and bacteria on every farm and in every plant that could cause an equally damaging event. We all must be vigilant that our practices and processes promote the production of milk of the highest possible safety and quality.



All milk safety and quality starts at the farm. Think of the adage "A good jockey can't make a bad horse win, but a bad jockey can make a good horse lose." Good product cannot be made from bad raw milk, but good raw milk can be harmed at the plant. Farmers and processors are in a mutually reliant relationship.

In addition to the effect that milk quality and safety has on the larger dairy industry, there are clear impacts at the farm level. First and easiest to quantify is the economic impact of maintaining a clean and compliant facility. Farms that are not in substantial regulatory compliance are at risk of being excluded from the marketplace. It does not take too many days of dumping milk to do substantial damage to a farm's bottom line. That is a risk that farms must not take. The primary intent of national and local dairy farm regulations is to ensure that the equipment and facility are clean so as to not harbor disease causing organisms. They are for the most part reasonable and inexpensive to comply with. An inspector I know says "Clean is cheap." You do not have to have a new or expensive facility for your farm to be clean. National and local regulations are aimed at protecting the safety of the food produced on your farm. Work with your inspector to ensure that your farm is meeting applicable regulations. It will help to ensure the milk you produce is safe to be used as food, and will ensure you access to a market.

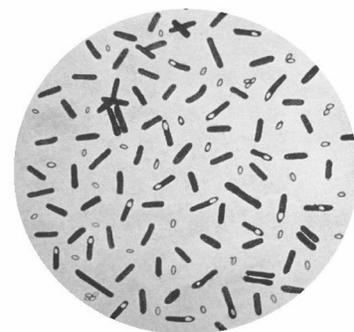
Another easily quantifiable benefit is the additional premium most markets pay for high quality milk (and the deductions taken for poor quality milk). These premiums are often

based on bacteria levels, including the standard plate and the preliminary incubation counts, somatic cell levels and cryoscope, antibiotic residue and other adulteration tests. Again, these levels are indicators of both food safety and milk quality. While pasteurization has greatly improved milk safety, it does not sterilize milk. Some bacteria survive pasteurization and create problems in the end product. Depending on the species, these bacteria can impact product texture and consistency, flavor, shelf-life and spoilage (milk quality). Again, depending on the species of bacteria, they can also cause serious food poisoning and death (food safety). *Staphylococcus aureus* grows quickly in warm milk and produces toxins that cause food poisoning. Symptoms include nausea, vomiting, stomach cramps and diarrhea. Cooling your milk properly is critically important to food safety.

High somatic cell levels primarily impact product quality. Drinking high somatic cell count milk will not kill you. But studies have shown that yield, flavor and spoilage are dramatically impacted (Auld and Hubble, 1998). High SCC cheese is also softer with more textural and flavor defects (Rogers and Mitchell, 1994). When milk with SCC >400,000 is used to produce yogurt, taste and consistency after 20 and 30 days storage is significantly affected (Oliveira, 2002). In fluid, milk with low SCC has higher flavor scores for up to 7 days longer than high SCC milk (Ma et al, 2000) (6). It is obvious why processors are willing to pay extra premiums for milk with low somatic cell levels.

But what about on the farm? Aside from the extra premiums for high quality milk and the deductions for low quality milk, there are less obvious benefits. First, cows with low somatic cell counts will produce substantially more milk over their lifetimes as milk producing cells are damaged with every case of mastitis. The cost of treatment and milk withhold cannot be ignored. Every time a cow is treated with antibiotics, there is a risk of contaminating the milk offered for sale. Farms that manage for higher quality milk are less likely to have rejected loads for any cause - bacteria, somatic cell or antibiotic residues. With the cost of a rejected load of milk topping \$10,000, that is no small benefit. The pride that comes from producing a high quality product should be important to producers too. We are offering food to the public. Just as you would not want to serve someone a bad meal in your home, you should not want to offer bad food for sale.

You cannot open a dairy magazine or talk to your milk inspector without hearing about the importance of milk quality - new tests, stricter standards applied to old tests, miraculous benefits, etc, etc. While getting bogged down in the details of problem solving and economics and management, we may forget to think about the real reasons that food safety and milk quality are truly important. Consumers trust us to supply them with a safe, nutritious product that will not cause harm to them or their family. Processors need us to supply them with the raw material that will yield an appealing, saleable product. The world gets smaller every day. Be aware of how quickly the milk you produce can move around the world, and how one batch of bad product can have a huge impact on world markets and consumers' trust in our wholesome, nutritious product. Watch your farm's milk tests - check them at least weekly. If you have a test result outside quality parameters, identify the cause, correct it and do your best to prevent it from happening again. Make sure none of the piping on your farm "is not as sanitary as it should be." Your diligence will be of immediate benefit to your farm, and of benefit to the dairy industry as a whole. We must not lose the confidence of our customers.



Clostridium botulinum under the microscope, showing cells and spores.

1. **NZ's Fonterra finds botulism bacteria in dairy ingredient.** <http://news.yahoo.com/nzs-fonterra-finds-botulism-bacteria-dairy-ingredient-033635231.html>
2. **Fonterra botulism scare leads to import ban in China, Vietnam and Russia.** <http://www.theguardian.com/world/2013/aug/05/fonterra-botulism-import-ban>
3. **Fonterra botulism scare caused by dirty pipe.** http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=10907604
4. **Fonterra Botulism Crisis was False Alarm.** http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=11115784
5. **Fonterra Absolved in Dairy Botulism Scare.** <http://www.foodproductdesign.com/news/2013/08/fonterra-absolved-in-dairy-botulism-scare.aspx?i-frame=true&width=90%&height=90%>
6. Steve Murphy, Senior Extension Associate, Cornell University.