

Program on Dairy Markets and Policy Information Letter

Acidity is not a Synonym for Toxicity

Information Letter 13-02

May 2013

Andrew M. Novakovic*

News and Not News

For every three or four ounces of milk, Chobani and other companies can produce only one ounce of creamy Greek yogurt. The rest becomes acid whey. It's a thin, runny waste product that can't simply be dumped. Not only would that be illegal, but whey decomposition is toxic to the natural environment, robbing oxygen from streams and rivers. That could turn a waterway into what one expert calls a "dead sea," destroying aquatic life over potentially large areas. Spills of cheese whey, a cousin of Greek yogurt whey, have killed tens of thousands of fish around the country in recent years.

<http://modernfarmer.com/2013/05/whey-too-much-greek-yogurts-dark-side/>

The production of the smooth, creamy and protein-packed breakfast food that has made brands like Fage and Chobani household names creates massive amounts of a toxic by-product called acid whey.

http://www.nypost.com/p/news/national/greek_yogurt_has_toxic_waste_problem_HQblzHeER9GNEfw27wtPMO

When a dog bites a man that is not news, but when a man bites a dog that is news.

Charles Anderson Dana, American journalist, 1819-1897

*Andrew M. Novakovic is the E.V. Baker Professor of Agricultural Economics in the Charles H. Dyson School of Applied Economics and Management at Cornell University. The Information Letter series is intended to provide timely information or an interpretation of current events or policy development for Extension educators, industry members and other interested parties. The author reserves all copyrights on this paper, but permission is granted to quote from the paper or use figures and tables, provided appropriate attribution is made.

Recently, the media has been abuzz with what *The New York Post* headlined as follows:

Greek yogurt's half a supertanker per year toxic waste problem

By MICHAEL BLAUSTEIN. Posted: May 22, 2013

Apparently some journalists find it more appealing to be dramatic than accurate or realistic and, in the spirit of Charles Dana, find the whey by-product of one of the latest food phenomena – Greek yogurt – to qualify as a man biting the dog. You can almost hear them saying: and here you thought Greek yogurt was a good thing?

Let's illuminate this "news" expose with a few facts.

What is Whey and What Does It Have to Do With Yogurt?

Yogurt is a dairy product produced by bacterial fermentation of the lactose component of cow's milk that has been heated to high temperatures to enhance the texture of yogurt. The fermentation process produces lactic acid that in turn causes milk proteins (primarily casein) to change their physical structure. In yogurt, the structure becomes a viscous liquid. The combination of the changes in physical structure and the conversion of lactose to lactic acid produces yogurt's characteristic texture and tangy taste.

Strained yogurt begins as described above but adds a step in which liquid whey (containing water, lactose, some protein and minerals) is caused or allowed to drain out of the yogurt mass, resulting in a yogurt with thicker consistency and a more tart taste (more acidic) than unstrained yogurt. As the word implies, straining traditionally occurs by placing the yogurt into a cloth or paper filter and simply allowing it to naturally drain for a period of time. High volume production of strained yogurt usually employs centrifugation to "spin" the yogurt mass and force out the liquid whey more rapidly.

Strained yogurt is typical of the Mediterranean region, including North Africa, Southern Europe, and West Asia. In the U.S. we have come to generically refer to this type of yogurt as Greek yogurt. This is probably because of the generally positive and familiar image of Greek cuisine and the importance of the Greek dairy company Fage in introducing their strained yogurt product, made in Greece, to New York markets beginning in 1998. Like many dairy products, there is a federal standard of identity for yogurt, but strained or Greek yogurt is not a uniquely defined product. In other words, companies who proclaim their product to be Greek yogurt must conform to the federal standard for yogurt but the claim of being "Greek" is a connotation, not a well-defined or legal designation.

There are also products labeled as Greek, or with suggestive names of that sort, which do not involve "straining". These products aim to produce a product with similar sensory and nutrient characteristics using different processes. One likely input is milk that has been subjected to ultra-filtration (UF), a type of mechanical concentration. The UF retentate can be added to fresh milk as either a dried or fresh milk protein concentrate (MPC). Another alternative is to use a similar product derived from cheese whey, called Whey Protein Concentrate (WPC). As a general rule, dairy protein concentrates are added

to achieve a higher protein content, in the vicinity of strained yogurts. This usually, by itself, does not result in the same product consistency as strained yogurt. Thus, it is also common that other, food grade, non-dairy thickening agents will be added. Consumers can determine whether the product is strained or not by examining the Ingredient Statement; strained or spun yogurts will not typically include ingredients such as whey protein concentrate, milk protein concentrate, modified food starch, gelatin, and/or pectin.

Conventional yogurt and conventional yogurt to which MPCs, WPCs, and/or gelatins have been added do not have a significant whey by-product. Strained yogurt, because it involves physically separating liquid (mostly water) from what would otherwise be conventional yogurt, does result in large volumes of liquid whey.

Whey is also a by-product of cottage cheese and natural cheese. In the case of yogurt and cottage cheese, coagulation of milk proteins is achieved by fermentation of lactose to produce lactic acid and the whey that results is acidic. In the case of natural cheeses, such as American style cheddar or mozzarella, curd formation occurs because of the addition of an enzyme to milk - rennet, so the acidity of the whey is held to a lower level (less acidic) to achieve the desired flavor and texture.

So Just How Acidic is Acid Whey?

The most common measure of acidity is the pH scale.¹ A pH of 7 is considered neutral. Below 7 is acidic; above 7 is alkali or basic. Battery acid has a pH of 1; lye has a pH approaching 14. Foods can exhibit a range of acidity, typically from 2 to 8.² Some examples of foods that span a range of pH are as follows:

Food	pH	Food	pH
lemon juice	2.0	maple syrup	4.6
applesauce	3.3	soft drinking water	5.0
raisins	3.8	cow's milk	6.5
wine, beer	4.0	baking soda	8.3

The whey from natural cheeses is referred to in the dairy industry as "sweet whey." This is not because it is sweet to the taste but rather because it is less acidic than the whey from cottage cheese, and now more recently, Greek or strained yogurt. Sweet whey can be anywhere from 5.2. to 6.4 pH and averages about 6.0. Thus, sweet whey is, strictly speaking, acidic (< 7.0), but it is very mildly acidic. Acid whey from cottage cheese or strained yogurt can range from 4.4 to 4.8.

Thus, the acidity of acid whey is comparable to the acidity of maple syrup, tomatoes, or bananas.

¹ <http://chemistry.about.com/od/chemistryglossary/a/phdef.htm>

² <http://www.medicinalfoodnews.com/vol04/issue4/acidity.htm>

Is Acid Whey Toxic?

toxic | 'tāksik|

adjective

poisonous: the dumping of toxic waste | alcohol is toxic to the ovaries.

- *relating to or caused by poison: toxic hazards | toxic liver injury.*
- *very bad, unpleasant, or harmful: a toxic relationship.*

Dictionary, Apple Inc. ver.2.2.3

acid | 'asid|

noun

a chemical substance that neutralizes alkalis, dissolves some metals, and turns litmus red; typically, a corrosive or sour-tasting liquid of this kind: rainwater is a very weak acid | traces of acid. Often contrasted with alkali or base.

adjective

containing acid or having the properties of an acid; in particular, having a pH of less than 7: poor, acid soils. Often contrasted with alkaline or basic.

sharp-tasting or sour: acid fruit.

Dictionary, Apple Inc. ver.2.2.3

Acid whey is, in the chemical sense, acidic. It also qualifies in the less formal sense as "sharp-tasting", like the tangy, tart, or sour taste of strained yogurt. Does this equate to "toxic" or poisonous? Recent reports have described the whey from Greek yogurt in dire terms, including references that it is toxic. The original story appearing in *Modern Farmer* sets up a straw man by saying that if acid whey were dumped into a stream it would kill the fish. That is true. The same would be true if one dumped thousands of gallons of tomato juice into a stream. This is precisely why the food industry doesn't do this, and there are regulations in every state that would severely punish anyone who did, either by accident or purpose.

Other stories "remind" us that sweet whey has been dumped into streams with disastrous effects on the ecology of the dumpsite. *Modern Farmer* refers to the "killing of tens of thousands of fish"..."in recent years". The most recent story to which they reference this claim is dated 2008. A Google search pulls to the first page a case of willful dumping that occurred in 1982. Can a large amount of whey dumped into a stream kill fish and generally make a terrible ecological mess? Yes. Does it happen often? No! Is it something one should lie awake at night fretting about? For my money, there are a lot of other things far more deserving of night sweats.

So What Happens to Acid Whey?

Most of the acid whey from strained yogurt production is transported to dairy farms as a liquid and fed to cattle. It is not an especially valuable cattle feed, but it can be blended with other feeds and replace some of the protein and energy nutrient requirements that otherwise would be met with more expensive feeds. Generally, the yogurt manufacturer bears all the cost of firstly purchasing the milk from which the whey is derived and secondly transporting it to farms.

There is some use of acid whey in methane digesters. This is a technology that sounds very appealing, but it remains somewhat in its infancy as a reliable and cost-effective way to use whey.

Lastly, there are new technologies being explored to process acid whey into human food products. After all, whey is primarily carbohydrates, proteins and minerals. Sweet whey from cheese making has become a valuable food source in making a variety of whey protein and lactose products. Acid whey has added processing complications, but it is conceivable that high quality human foods could be made from this byproduct of strained yogurt manufacture.

In the meantime, there are a lot more scary things we can genuinely worry about than acid whey.