FEDERAL MILK MARKET ORDER HEARINGS OCTOBER 2023

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My name is Dean Sommer. My current position is a Cheese and Food Technologist, and a member of the senior team, at the Center for Dairy Research (CDR) in Madison, WI. I have been at the CDR for 20 years. In my capacity at CDR, I work with cheese manufactures large and small across Wisconsin and across the United States. Prior to that I worked at Alto Dairy for 18 years, starting as the Director of Technical Services, progressing to Vice President of Technical Services, and lastly as Vice President of Operations. When I started at Alto it was a Cheddar manufacturer and the largest and newest cheese factory in the U.S. Alto Dairy was a cooperative with ultimately 2 large cheese plants in Waupun, WI, one Cheddar and one Mozzarella, as well as a large, aged Cheddar plant in Black Creek, WI. At the time I left Alto we manufactured over 200 million pounds of cheese per year, about half of that Cheddar. I have a M.S. degree from UW Madison in Food Science.

FAT LOSSES IN CHEDDAR CHEESE MANUFACTURE

Today I will be testifying on fat losses in the cheddar cheese manufacturing process. I will not be addressing farm-to-plant losses but will be discussing fat losses after the arrival of milk at manufacturing plants.

History of fat loss estimation in Cheddar cheese manufacturing

Around a century ago Van Slyke and Price estimated that if Cheddar cheese was manufactured and handled to near perfection fat recovery would be around 93%. This work was done with the open cheese vats of the day. Dr. David Barbano of Cornell University did a study published in 1984 that tested fat recoveries with the advent of newer and more

advanced cheese making vats and equipment, including some cheese factories with new enclosed 'OO' vertical vats and some with open vats, to see if that 93% fat recovery still held true. Surprisingly, Dr. Barbano found in 4 good sized Cheddar cheese factories in New York state that the fat recoveries were much lower than expected, coming in at 87.2, 86.3, 85.2 and 82.8%.

Newer vat designs capture more fat in the curd at the vat.

Today, almost 40 years later, with further improvements in cheese vat designs, commonly called horizontal cheese vats, fat retention potential in cheese vats has improved. In my work at CDR with companies with open vats, I have seen fat losses in whey after cutting in open vats around 9-10%. In my experience at Alto with 'OO' vats I saw fat losses of around 7% after cutting. In my experience at Alto with horizontal cheese vats I saw fat losses of around 6% after cutting. I have heard anecdotal reports of the most modern vats of fat losses of less than 5% after cutting. Please note these figures only represent fat losses in the cheese vat after cutting and are not considering other points of fat loss in the Cheddar cheese making system which I will address.

'OO' vats and even open vats are still in widespread use in the Cheddar cheese industry.

It should be noted that while many large, modern plants have installed the newest and most efficient horizontal vats, 'OO' vats and even open vats have not gone away in the Cheddar industry. A number of prominent, large Cheddar manufacturers continue to use 'OO' vats. And inevitably when a manufacturer converts from 'OO' vats to horizontal vats, the 'OO' vats don't disappear, they merely get refurbished and then installed in typically a smaller, older cheese factory. And many small, artisan Cheddar cheese manufacturers continue to use open vats.

The take home message here is Cheddar makers in the U.S. continue to use an assortment of cheese vat styles. While the newest, most modern plants have largely gone to the most efficient horizontal vats, some large factories, and many medium and small factories continue to use 'OO' or open cheese vats.

Fat losses in the vat at cutting only tell part of the story of fat losses in Cheddar cheese manufacturing.

One concept that must be considered on the topic of fat retention is where fat losses occur during Cheddar cheese manufacturing. Most people focus solely on fat losses in whey (called sweet whey) after cutting the coagulum, and often refer to this as the only source of fat loss during Cheddar cheese manufacture. **Taking this approach will significantly underestimate total fat losses in Cheddar manufacturing**. While cutting the coagulum is an important point of fat loss, it is far from the only point. Other significant points of fat loss are milk shrinkage from the raw milk silos to the vat (milk residue left in silos and lines; milk filter rotation and flushing; milk clarifier desludging; pasteurizer start up and shutdowns. Collectively this could amount to up to 1% of total milk volume, thus up to 1% of total fat loss).

Fat losses in whey in the vat fails to account for further fat losses downstream in the Cheddar making process in the form of salty whey.

Another significant loss of fat occurs during the salting process of cheddar cheese curds, resulting in salty whey. This step occurs relatively late in the cheesemaking process. Some of this salty whey occurs immediately on the curd table or salting belt after dry salt is applied. More salty whey is generated in 40lb block forming towers, or in the pressing and initial cold storage of 640lb blocks of cheese. This salty whey can comprise up to 5% of the total whey volume generated (with sweet whey (before salt addition) comprising 95% of the total whey

volume). Salty whey is significantly higher in fat content than sweet whey. In a study by Blaschek, Wendorff and Rankin at the University of Wisconsin where they surveyed sweet and salty whey from 8 commercial Cheddar cheese plants, they found an average fat content of salty whey of 0.6%, approximately 3 times higher than sweet whey. Taking into account the volumes of sweet and salty whey, as well as the typical fat contents of sweet and salty whey, a calculation reveals that salty whey accounts for approximately an additional 10% of the total fat loss in all generated whey. This occurs late in the cheesemaking process and is not accounted for in tests for fat losses in whey sampled at the vat.

Cheese fines collected from the whey and not returned to the body of cheese represents a significant source of fat loss.

A further significant loss of fat in Cheddar cheese manufacture is loss of cheese fines. In today's quality and food safety conscious world, adding back cheese fines recovered from the whey back to the bulk of the cheese curd is largely not done anymore due to concerns with coliform and other bacterial contamination risks and associated cheese quality concerns. In a recent conversation with a large U.S. aged Cheddar manufacturer, it was related to me that they lose approximately 0.25-0.3% of their curd production to cheese fines which do not go back into finished cheese. This was at a factory using a matting conveyor which minimized cheese fines. Factories making stirred curd cheddar on curd tables generate significantly more fines due to the design of the whey drainage screens and agitators on curd tables. Based on my experiences at Alto and in a recent personal conversation with a large Wisconsin stirred curd Cheddar manufacturer, I would estimate that fines losses in these systems are 0.5-0.6% of total cheese volume, which is approximately double that of cheddar factories with matting belts.

Remembering that this curd contains up to 34% fat, this is a significant amount of fat loss.

Other points of fat loss in a Cheddar cheese make:

There are additional points of fat loss during Cheddar cheese manufacture. I visit dozens of cheese plants every year as part of my duties at CDR. Inevitably I observe when walking through a plant some cheese curds on the floor. These losses are to some extent not preventable given the design of today's automated equipment. These curds are disposed of as inedible and represent further losses of fat. Plants producing 640 lb blocks of Cheddar inevitably have salt whey drippings directly from the 640s when they are stacked in the coolers. This is because these giant blocks are not vacuum sealed, and gravity forces some of the free whey in the blocks to leak out and puddle on the cooler floor. Occasionally vats of cheese have to be disposed of due to contamination with foreign materials due to some unexpected equipment breakage. This also represents loss of fat. Finally, a historical benchmarking standard for cheese quality has been that the very best run Cheddar plants can achieve 99% at grading, with 1% of their cheeses being graded as B grade or Undergrade and needing to be sold at discount prices. In my current experiences few Cheddar plants meet these standards today, and many fall far below that number. A large, national, reputable cheese conversion and marketing company that manages downgraded cheese for cheese manufacturers recently related to me they estimate around 5% of current Cheddar manufactured in the U.S. gets downgraded and discounted.

The latest cheese vat design does not guarantee optimal fat retention in the cheese.

Lastly, it should not be dismissed that the cheesemaker's skills continue to play an important role in determining fat retention in cheese,

regardless of equipment design. Cheesemaker practices such as general make procedures, vat operation step programming, choice of coagulant, method of using the coagulant, coagulum firmness at cutting, cut curd size, gentleness of handling the curd, proper development of curd body and texture, transfer of the curd to tables or belts, and more will affect how much fat is retained in the finished cheese. The take home message here is that cheesemaking is still a cheesemaker driven system. I have seen many instances where a cheese factory had good equipment, but in the hands of inexperienced cheesemakers large fat losses still occur.

The addition of whey cream to milk for Cheddar cheese manufacturing will inevitably result in higher fat losses during cheese manufacture.

Milkfat globules are damaged when they go through the cheese making process. Thus, milkfat globules that escape into whey and subsequently are recovered in whey cream are damaged and are typically smaller in size than milkfat globules in the original milk. When whey cream is added to milk for cheesemaking, these smaller, damaged fat globules more easily leak out of the curd matrix and into the whey, thus increasing losses of fat in whey during cheesemaking. This problem worsens the more consecutive days that whey cream is added back to milk for cheese making, as these small fat globules recycle over and over. Typically cheese factories need to break the cycle by periodically shipping out whey cream to remove the damaged fat globules from the system. Cheese factories that utilize whey cream for cheesemaking will not achieve optimum fat recoveries.

Conclusions

Most plants that I visit only consider the fat lost when cutting their coagulum when they talk about fat retention in their factories. Taking this approach will significantly overestimate fat recovery numbers in

these operations. My belief is that fat losses other than the fat lost at cutting the coagulum represent from 25-50% of the total fat lost during the entire cheesemaking process. My best estimate of fat recoveries in cheddar cheese manufacture, taking into account personal experience as well as recent communications with some well managed Cheddar cheese factories, would be in the range of 91-93% in well run factories with modern, horizontal vats, 90-92% in well run factories with vertical 'OO' style vats, and 88-91% fat recovery in factories with traditional open vats. My esteemed colleague and distinguished scientist Dr. Mark Johnson recently wrote me on the topic that actual yield and fat recovery is normally significantly less that predicted yield and fat recovery, "*So fat recovery in a yield equation will always be an overestimation of reality…why they are called a predictive yield equation."*

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Volume 67, Issue 8, August 1984, Pages 1873-1883

Research-Article

Cheddar Cheese Yields in New York

D.M. Barbano, J.W. Sherbon

Journal of Dairy Science
Volume 90, Issue 4, April 2007, Pages 2029-2034

Article

Survey of Salty and Sweet Whey Composition from Various Cheese Plants in Wisconsin

K.M. Blaschek, W.L. Wendorff, S.A. Rankin