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Pink Slime, Deconstructed

By See Arr Oh | March 27, 2012

“I don’t eat school lunch anyway . . . It looks weird.”

BPI / The Atlantic

This is from a high school student, quoted in the *New York Times* over the weekend, in response to a seemingly “beefless” future in school cafeterias. Most of the recent media outcry surrounds “pink slime,” the low-fat filler used to bulk up many processed meats. Coverage focuses on schools, where parents and administrators alike worry about students’ exposure to “chemically-treated” foodstuffs and poorly-labeled processed meat.

The low-cost, nutritious school lunch has long been an American institution. Smaller school budgets and larger student populations have led to schools cutting costs wherever possible. When industrial beef producers suggested a newer, cheaper meat alternative back in the early ‘90s, cash-strapped school districts happily agreed.

In 2010, Michael Moss of the *New York Times* won a Pulitzer for reports probing the processing end of the beef industry. He was among the first to explore the sterilization process, microbial testing, and potential contamination recalls over the past decade. Today, more journalists, along with celebrity chefs, moms, and school officials have all taken up torches and pitchforks against “pink slime”. Online articles address a myriad of questions: Where does this product come from, and where does it end up? Is it OK to eat? Why aren’t all the ingredients labeled? How is it made, anyway?

But thus far, no one has really satiated my curiosity…what, exactly, ***is*** “pink slime?”

What Pink Slime Is, and What It’s Not

Let’s address the name – there’s undeniably an “*‘ick factor’…ever heard anyone use [slime] in a positive way?*” (Borrowing a pithy phrase from Deborah Blum, who covered the subject for Discover Blogs)

Well, if you come from the meat producers’ camp, you instead refer to “slime” as lean, finely-textured beef, or LFTB. Connective tissue, trimmings, and scraps from industrial butcher plants are mixed in a large steel reactor, where technicians heat the mixture to 100 ^{o}F, initiating tissue lysis – fats and oils begin to rise up, while thicker bits like protein sink. After a spin on the centrifuge to separate these components, lean, squishy pink goo emerges. Ammonium hydroxide – ammonia dissolved partially in water – sterilizes the resulting mass against microbes such as *E. coli* or *Salmonella. (Side Note: a similar product, finely textured beef, uses citric acid in place of ammonia to eliminate pathogens)*. Once extruded, the “slime” can be blended into hamburger, hot dogs, and other products, or frozen into pellets for shipping and storage.

But, is it nutritious? Consumers can certainly make valid arguments regarding LFTB’s content: there’s less overall “functional” protein than that found in other meat products. An analysis conducted at Iowa State University (A.S. Leaflet R1361) found two-and-a-half times more insoluble protein (77% vs. 30%) relative to soluble proteins in ordinary ground chuck. Nutritionally, our gut bacteria digest much of what we cannot, but there’s a good bet that we can’t get as much value from insoluble proteins (collagen and elastin, found largely in tendons, ligaments, and cartilage) as from their soluble siblings (myosin and actin, usually associated with muscle tissues). While these proteins may be hard to digest, on the plus side, there’s less fat in LFTB (~5%) than standard ground chuck (15-20%).

For those revolted by these contents, or even the thought of anything referred to as “slime” crossing their plates, I have two comments: first, consider Jell-O. The packaging only lists a single ingredient, which reads: gelatin. If you were to tell a child that “gummy worms” and other wobbly treats were made from steamed animal bones, would they really want dessert?

Second, consider checking the Code of Federal Regulations (CFR), the U.S. Gov’t standards used to coordinate aspects of daily life ranging from taxes to farming. In 9CFR 301.2, a collection of terms used in the meat packaging industry, we see the following definition for meat:

“*The part of the muscle of any cattle, sheep, swine, or goats, which is skeletal or which is found in the tongue, diaphragm, heart, or esophagus, with or without the accompanying or overlying fat, and the portions of bone…skin, sinew, nerve, and blood vessels which normally accompany the muscle tissue, and are not separated from it in the process of dressing.*”

Pretty gruesome reading, true, but realize that this explanation covers everything bought at the butcher, so think carefully when considering catch-all meat products like grounds, mush, pastes, or loaves. In this light, “slime” doesn’t seem half as bad; as a culture, we’ve implicitly agreed that throat, blood, and tendons are already on the menu.

Ammonia and Other Additives

Since we’re checking the CFR, let’s consider all the other approved meat additives we encounter there. Mosey on over to 9CFR 424.21 to find a table, no less than 20 pages in length, of all the allowable additives used in meat processing: tenderizers, emulsifiers, denuders, binders, bleaching agents, and sweeteners, all on display for the discerning diner’s palate. Compared to “pink slime” seeing only brief ammonia exposure, I’m more inclined to be suspicious of sausage.

Speaking of additives, what about the ammonium hydroxide? As Blum points out, you’ve eaten it before: close molecular cousins ammonium chloride (NH_4Cl) and ammonium phosphate [$(NH_4)_3PO_4$] are found in licorice and breads, respectively. Plant proteins like pectins and glutens are commonly treated with ammonia for various food applications. I’m less concerned with the ammonia treatment, but more with just how much ammonia a single batch of LFTB requires to make it “safe.” Levels high enough to raise the product pH to about 9.00 rid the beef of most virulent microorganisms, but batches tested by the *New York Times* back in 2009 showed pH levels as low as 7.75. So what, that’s not a huge difference, right? The pH scale tracks logarithmically, so a one unit variance actually corresponds to *10 times* less ammonia, which might reduce odor but also increases potential bacterial contamination.

Contrary to some news reports, ammonia is not a “pink chemical,” it’s colorless. Nor does the level of ammonia in meat even approach that found in floor cleaners. For my money, a more worrisome butcher’s helper comes from an entirely different source – carbon monoxide, which when applied to beef binds to the myoglobin and causes the tissue to develop the reassuring pink color consumers associate with freshness and quality.

One last safety note – perhaps the few examples of contamination detected *really are* outliers. Click here for the 40-page USDA checklist meat producers must complete to assess their sterilization measures. This document addresses all production activities, including testing regimens, sampling size, antiseptic washes, lot documentation, and cross-contamination checks. USDA even establishes a maximum target of **0.2%** for lot checking; or a tolerance of 2 per thousand lots produced with positive tests (*in 2007, positive tests had crept up too high, and USDA cracked down. Higher numbers of failed* *tests were also noted in Moss's 2009 Times article*). Surprisingly, a chart buried near the middle (p.13) of the checklist indicates that processed beef has a *lower* overall risk of bacterial contamination relative to standard raw beef.

"That's the thing…it isn't freaking labeled."

Healthy food, healthy kid; USDA

Microbiologist Gerald Zirnstein, a meat industry critic and the man whose 2002 email inadvertently coined the term "pink slime," delivered this rebuttal in a Reuters interview this past weekend. Under current regulations, LFTB does not have to be disclosed separately on labels, with the caveat that USDA allows a 15% maximum of the stuff in any product. However, a generation of parents accustomed to fighting high-fructose corn syrup and artificial dyes argue for inclusion of, at least, *ammonia* in the final ingredient list. Since manufacturers (and the USDA) consider this a production step, it, too, doesn't need to be discretely mentioned.

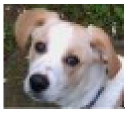
So, besides loose labeling and chemical treatment, what is it about this processed meat that so unnerves customers? Certainly, it doesn't look like a traditional cut anymore, but then neither does hamburger. The "slime" moniker doesn't help matters, nor its public unfamiliarity – slicing animals into sections has a long history in human culture, but secondary processing of the remains is more recent. Blame cultural context: while steaks, chops, and ribs are on menus everywhere, LFTB is not. Perhaps we haven't had time to adapt. Yet processed food still fills a necessary societal role – it's widely available, inexpensive, and can be fortified with nutrients and vitamins.

But is LFTB really **food** anymore? I would say yes, in the same way those byproducts from any other organism that we consume are. Surely, most people realize that we set our table every day thanks to the labors of other life forms: honey, from bee regurgitation, yogurt, from bacterial metabolism, and multiple cheeses from calf enzymes (rennets) or *via* fungal decomposition. Cochineal, a crimson dye still used to color meat products (9CFR, p. 624), comes from the dried, crushed bodies of millions of tiny insects. But, compared to insects and microbes, cows hit closer to home somehow, so we revolt at a meat byproduct we don't recognize.

So, for my final thoughts: to the beef industry, clearer labeling and heightened public awareness would help to quash some of the squeamishness at LFTB's inclusion in the food pantheon. And to the schools and parents, well-documented and tested LFTB doesn't seem to be much more harmful, albeit less nutritious, than the Jell-O we already serve at dessert.

Enjoy your school lunch. Bon appétit!

Note: the top image replaced on 3/28/2012.

**About the Author:** See Arr Oh is a medicinal chemist working in industry. He enjoys a burger, from time to time. See Arr Oh blogs at Just Like Cooking and contributes to several other blogs, including Chemjobber, Totally Synthetic, and CENtral Science's The Haystack and Newscripts Follow on Twitter @seearroh.