# Facts and Frequently Asked Questions About Lean, Finely-Textured Beef[1]

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Two very similar finely-textured beef products available commercially and produced from slightly different patented processes have received an increased amount of media attention recently, referred to in the media as "pink slime." The technology to produce these products has been utilized commercially within the US for more than 30 years:

- Beef Products Inc.'s (BPI) product, "Lean, Finely-Textured Beef" (LFTB; Roth, 1980), which accounts for the majority of the finely-textured beef product produced, or
- Cargill Meat Solutions' product, "Finely-Textured Beef" (FTB; Cargill Meat Solutions, 1995).

The intent of this factsheet is to answer some of the questions that consumers may have as a result.

Readers should note that prior to the USDA's 2001 approval of the use of finely-textured beef product in foods intended for human consumption, LFTB/FTB was used as an additive in many other products. In the years since, the addition of various treatment methods discussed herein have been documented as effectively improving the overall quality and safety of ground meat products.

## How many animals does a single ground beef patty come from?

This answer to this question is not definite. However, a commercially produced ground beef patty almost certainly comes from multiple animals. The likelihood that a given patty comes from one animal alone is very small. The only scenarios where your single ground beef patty is sure to come from a single animal would be:

1. if you were to ask your retail butcher to grind an existing roast or steak from the retail case,
2. if you were to buy custom ground beef from your local butcher, or
3. if you were to have the equipment to grind whole cuts of beef yourself.

## How is ground beef made commercially?

Commercially produced ground beef is generally made by combining a very lean source of beef (≤ 10% fat) with a relatively high-fat source of beef (≥ 30% fat) to produce a final product with a composition of no more than 20% fat.

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These different sources would almost certainly come from different carcasses (Berry et al., 1981).

## What pieces of beef are used to make finely-textured beef products?

Whole-cuts of beef, such as strip loins and briskets, have a specification for how much external fat can be allowed before they are transported to end-users. Some external fat removal from all of these pieces takes place at the packinghouse. When the external fat is cut off, small pieces of lean are included as well. Those small pieces of lean are what ultimately becomes LFTB or FTB. The fat pieces containing a small amount of lean are called "trim" or "trimmings," and are collected in large plastic-lined cardboard boxes or "combos."

## Is any of the beef used to make finely-textured beef products tested for pathogens that can cause foodborne illness?

Yes. The beef trimmings used to make LFTB or FTB must meet the same or greater microbiological requirements enforced by the USDA–Food Safety Inspection Service (USDA–FSIS) as a beef roast sold at your local retail food store or a steak served at your favorite steakhouse restaurant. These combos of fat trimmings contain no bones, tendons, spinal cord, or organ meats. Each combo of trimmings must be sampled and tested for *E. coli* O157:H7 (USDA–FSIS, 2004) and six other Shiga toxin-producing *E. coli* (USDA–FSIS, 2012) in accordance with USDA–FSIS regulations. Since 1994, products testing positive for *E. coli* O157:H7 have been declared "adulterated" and therefore ineligible for sale as fresh ground beef (USDA–FSIS, 2006).

## How are the trimmings actually processed to make LFTB or FTB?

The process is accomplished by heating the product to approximately 100°F (Roth, 1980; Cargill Meat Solutions, 1995), then separating the lean from fat with centrifugal force that is similar to methods for separating cream from milk. The liquefied fat is then food-grade beef tallow. The remaining lean product is then exposed to an additional antimicrobial intervention—brief exposure to either ammonium hydroxide gas (BPI) or citric acid (Cargill), both of which are on the GRAS (Generally Recognized as Safe) list of the USDA and the U.S. Food and Drug Administration (FDA, 2006). The lean product known as LFTB or FTB is then flash frozen, chipped into pieces, and pressed into 60 lb. blocks prior to distribution to ground beef manufacturers for its inclusion in formulations in which it comprises up to 20% of the final blend.

## What is the composition of the LFTB or FTB product?

These unblended products are typically 95% lean, 5% fat (± 2%), 14% protein, and 78% moisture (± 3%) (South Dakota Dept of Ag., 2012; Hobbs, 2012, as cited by Christensen, 2012).

## What purpose does ammonium hydroxide gas serve in the production of LFTB?

It does an excellent job of terminating the microbes that can cause foodborne illness. Niebuhr and Dickson (2003) inoculated beef trimmings with *E. coli* O157:H7, the primary microbe of concern with ground beef. The trimmings were then subjected to the BPI process, ultimately producing LFTB, after exposing the product to ammonium hydroxide gas to increase the pH of the trimmings from 5.7 to 9.6. The product was then frozen, chipped, and compressed into blocks as described earlier. Initial exposure to ammonium hydroxide yielded a tenfold reduction in the populations of *E. coli* O157:H7. No *E. coli* O157:H7 bacteria were detected after completing the rest of the BPI process, ultimately resulting in a 1 million-fold decrease. Also, when 15% uninoculated LFTB was blended with conventional ground beef trimmings that had been inoculated with *E. coli* O157:H7, to make blended ground beef patties as made commercially, the population of *E. coli* was decreased by twofold, just by including LFTB.

## Does any ammonia remain within LFTB?

Yes, a BPI spokesperson told *Food Safety News* that the company's unblended LFTB product contains between 400 and 500 parts per million (ppm) ammonia (Bottemiller, 2012). A South Dakota Department of Agriculture (2012) factsheet estimates that a finished, blended ground beef patty containing approximately 15% LFTB will contain 200 ppm ammonia, or a total of 40 mg of ammonia per 3.2 oz patty.

## How much ammonia does regular ground beef contain?

Conventional ground beef without LFTB contains 101 ppm of ammonia (Rudman et al., 1973), so the BPI process, for example, essentially doubles the amount of ammonia.

## How much ammonia do other foods contain?

Rudman et al. (1973) assessed 64 foods for ammonia content. Foods likely to be included on a cheeseburger, for example, were measured as follows for ammonia content:

- onions–342 ppm
- ketchup–411 ppm
- American cheese–813 ppm

## Is consuming trace amounts of ammonia safe?

Yes, it is safe. Estimates are that up to 17 grams of ammonia are ingested and/or metabolized each day by humans (WHO, 1986 as cited by Beattie, 2007). The amount of ingested ammonia from additives has been estimated at less than 0.02 g/day (WHO, 1986 as cited by Beattie, 2007). This is approximately 850 times less than the amounts produced endogenously and excreted by humans as urea and urinary ammonium compounds through the kidneys (WHO, 1986 as cited by Beattie, 2007).

## How much ammonia can be safely consumed each day by a healthy adult?

Studies with rodents and pigs suggest that a 120-pound human could consume from 4 to 27 g of ammonia per day and a 150-pound human could consume from 5 to 38 g of ammonia per day without adverse effects (WHO, 1986 as cited by Beattie, 2007). Assuming the lowest level of 4 g per day, and 40 mg of ammonia per patty, this would be equivalent to consuming 1,000 finished, blended ground beef patties containing LFTB each day. Data for other populations (older adults, children, pregnant women) are lacking.

## Why is LFTB or FTB not required to be listed specifically on the label of ground beef?

According to the FDA Code of Federal Regulations, specifically 21 CFR 101.100(a)(3), ammonium hydroxide and citric acid are considered processing aids. Processing aids are used to enhance a food's appeal or utility and are not required to be labeled because they do not technically alter the composition of the food. The FDA currently considers the ammonia associated with LFTB as an "incidental additive," a substance that remains in food at insignificant levels and does not change the food's overall function.

## Other than the residual ammonia in LFTB, is anything different about these products from conventional ground beef?

These products have been heated, which denatures some proteins; therefore, when the finished LFTB or FTB products are thawed, they have a different, softer, finer texture than conventional trimmings or ground beef (Bottemiller, 2012).

The products are made from the very small pieces of lean that are essentially the outermost portion of a muscle. The outermost portions of all muscles have a significant layer of connective tissue, the epimysium (Forrest et al., 1975), which is primarily comprised of the protein collagen. This could contribute to the findings of He and Sebranek (1996) who reported LFTB to have a higher concentration of collagen compared to traditional beef chuck trimmings.

In addition, according to some who have handled LFTB first-hand and as cited by Bottemiller (2012), an unblended block of LFTB still smells of ammonia. However, the residual ammonia dissipates or dilutes in the ground beef mixture once the product is mixed with conventional trimmings. Therefore, finished, blended ground beef patties containing up to 20% LFTB do not have a detectable odor of ammonia (Bottemiller, 2012).

## Is there anything else consumers should know?

Yes. LFTB has been shown to improve several variables of ground beef quality. Researchers at the University of Arkansas recently conducted a study on ground beef quality and reported that adding up to 20% of LFTB within the final product improved the color, reduced spoilage, and improved the tenderness of the patties, compared to the control patties without any LFTB (Moon et al., 2012).

In addition, cooking foods to their Safe Minimum Internal Temperatures is one of the most important elements of preventing foodborne illness. For more information about food safety in the home, see https://edis.ifas.ufl.edu/entity/topic/home_food_safety.

## Literature Cited

Beattie, S. 2007. A brief statement of the use of ammonium compounds in food processing: Nutriphysiological perspectives. Accessed at http://www.beefproducts.com/ISU-Ammonium.pdf on July 23, 2012.

Berry, B. W., W. H. Marshall, and E. J. Koch. 1981. Cooking and chemical properties of raw and precooked flaked and ground beef patties cooked from the frozen state. *J. Food Sci.* 46:856–59.

Bottemiller, H. April 2, 2012. Slimegate: Should USDA require labeling for LFTB? *Food Safety News*. Accessed at https://www.foodsafetynews.com/2012/04/slimegate-should-usda-require-labeling-for-lftb/ on July 23, 2012.

Cargill Meat Solutions, D. L. Schaefer, R. M. James, and M. E. Rempe. 1995. U.S. Patent No. 5725897. Washington, DC: US Patent and Trademark Office.

Christensen, L. M. 2012. Evaluation of textural properties of cooked beef batters. MS thesis–California Polytechnic State University San Luis Obispo, CA. Accessed at https://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1769&context=theses on July 23, 2012.

Code of Federal Regulations (CFR). Washington, DC: US Food and Drug Administration, cited by USDA Food Safety and Inspection Service (USDA–FSIS) in *Compliance Guide on the Determination of Processing Aids* (2008). Accessed at https://www.fsis.usda.gov/sites/default/files/import/Determination_of_Processing_Aids.pdf on February 7, 2023.

FDA (US Food and Drug Administration). 2006. Ammonium hydroxide. Washington, D.C. Accessed at http://www.accessdata.fda.gov/scripts/fcn/fcnDetailNavigation.cfm?rpt=scogsListing&id=27 on July 23, 2012.

Forrest, J. C., E. D. Aberle, H. B. Hedrick, M. D. Judge, and R. A. Merkel. 1975. *Principles of Meat Science, 2nd Edition*. New York: Freeman and Company.

He, Y. and J. G. Sebranek. 1996. Frankfurter with lean finely textured tissue as affected by ingredients. *J. Food Sci.* 61:1275–79.

Hobbs, M. 2012. Personal Communication. January 16, 2012.

Moon, C. T., J. W. Yancey, J. K. Apple, J. J. Hollenbeck, T. M. Johnson, and A. R. Winters. 2012. Lean beef trim improved fresh and cooked quality characteristics of ground beef patties. University of Arkansas Gamma Sigma Delta Society. Accessed at https://news.uark.edu/articles/17999/study-shows-lean-finely-textured-beef-improves-burger-quality on February 7, 2023.

Niebuhr S. E and J. S. Dickson. 2003. Impact of pH enhancement on populations of *Salmonella*, *Listeria monocytogenes*, and *Escherichia coli* O157:H7 in Boneless Lean Beef Trimmings. *J. Food Protection* 66:874–77.

Roth, E. 1980. U.S. Patent No. 4192899. Washington, DC. U.S. Patent and Trademark Office.

Rudman, D., R. B. Smith, A. Salam, W. D. Warren, J. T. Galambos, and J. Wegner. 1973. Ammonia content of food. *Am. J. Clin. Nutr.* 26:487–90.

South Dakota Dept. of Agriculture. 2012. Lean, finely-textured beef fact sheet. Accessed at http://sdda.sd.gov/LFTB%20Fact%20Sheet.pdf on July 23, 2012.

USDA–FSIS. 2004. FSIS Directive 10,010.1 Rev. 3: Verification activities for *Escherichia coli* O157:H7 in raw beef products. Washington, DC. Accessed at http://www.fsis.usda.gov/OPPDE/rdad/FSISDirectives/10010.1Rev3.pdf on July 23, 2012.

USDA–FSIS. 2006. Timeline of events related to *E. coli* O157:H7. Washington, DC. Accessed at http://www.fsis.usda.gov/PDF/Ecoli_O157_Timeline.pdf.

USDA–FSIS. 2012. FSIS verification testing for non-O157 Shiga toxin-producing *Escherichia coli* (non-O157 STEC) under MT60, MT52, and MT53 sampling programs. Washington, DC. Accessed at https://www.foodpoisoningbulletin.com/wp-content/uploads/FSISNONSTECNOTICE.pdf on February 7, 2023.

WHO (World Health Organization). 1986. *Environmental Health Criteria 54: Ammonia*. Geneva.