



January 31, 2008

FAPC Provides Advice on Approach to Current Concerns with *E. coli* O157:H7* on Raw Meat Products

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The issue: incidence of contamination of raw/ground beef with *E. coli* O157:H7 is so low that microbial testing for its presence/absence is more a matter of appearance than of substance. The USDA-FSIS has established a “zero tolerance” for *E. coli* O157:H7 in raw ground beef because of the severity of the illness, and product containing the live organism is considered “adulterated.”

Current practice. The USDA-FSIS has established microbiological sampling guidelines for slaughter and raw beef processors to test for *E. coli* O157:H7 in addition to its own random sampling program. Because of the recent uptick in *E. coli* O157:H7 outbreaks in 2007, it has been stated that USDA-FSIS is enhancing its sampling programs.

The problem. The main dilemma is the level of *E. coli* O157:H7 and incidence in retrieved samples is so low that it is most often below the level of detection. It is hard to imagine that the retrieval of a 325-gm sample (i.e., the current sample testing size, approximately 0.7 pound) from large production lots of ground beef (say 20,000 pounds) can give reasonable assurance that the remainder of the large production lot is free from *E. coli* O157:H7. For instance, consider that the incidence of *E. coli* O157:H7 was 29 positives from 12,200 samples tested (i.e., USDA-FSIS results for 2007). I commonly use an analogy of filling an auditorium with 20,000 coffee cups to represent that 20,000-pound batch of ground beef and suggest a marble be placed in 48 coffee cups to represent that same *E. coli* O157:H7 incidence obtained from USDA samplings (i.e., 29 in 12,200 = 48 in 20,000). Therefore, a test sample size of 1 pound, or 1 coffee cup, would allow you 1 selection to possibly detect one of the 48 of the 20,000 samples that may contain the *E. coli* O157:H7. With those kinds of odds, testing will more likely miss samples containing *E. coli* O157:H7 than detect them should they be there (at very low incidence levels), even if you were to increase your sampling size by 10-fold, such as 10 selections to pick the possible 48 out of 20,000. If I were to ask you, if you had a test or assay that when used cannot validly give you a result for which it was intended (i.e., accurately determine if *E. coli* O157:H7 is present/absent in the large production lot), would you call that a valid test? If the answer is “no,” should we not seek a better alternative?

The burden falls on smaller processors. The “problem” is further exacerbated due to the nature of the business. Large manufacturers divide up large production lots and sell smaller portions to various processors who also have to sample their raw ground product using the same sample size but on a smaller overall lot size. This results in testing a higher proportion of their (smaller) total lot size than

was tested by the larger processors. However, if they should find *E. coli* O157:H7 that may have been missed from the large original lot sampling by the larger processors, then it becomes their problem.

Recent approaches. It has been suggested “better testing methods” are needed. Better methods always are desirable and there always will be an effort to improve them. However, in this case a “better method” only would be helpful if you picked one of the 48 coffee cups that may contain *E. coli* O157:H7. A better microbiology test method will not help you to determine if *E. coli* O157:H7 is in the large production lot if you selected a sub-sample that does not contain the bug (i.e., 19,952 of the 20,000 coffee cups). Selecting more coffee cups (i.e., larger sampling sizes) improves your odds but still offers more misses than hits.

How can we defeat this dilemma? Searching for improved and rapid methods of detection always will be an approach in combating food borne pathogens. However, a valid “sampling method or assay” presumes the target agent is distributed sufficiently in the test lot and the testing of smaller retrieved samples will determine if it is present in the large lot. No assay can overcome the logistics of the low *E. coli* O157:H7 levels that are below the level of detection (referring to the large production lot, not the approximate 1-pound sample). Food microbiologists often use “enrichment” to increase low bacterial levels to higher, more readily-detectable levels, but that is only within the retrieved sample to be tested and cannot be done with the entire production lot. In my opinion, the effort that would be better spent and likely have greater success in reducing the incidence of *E. coli* O157:H7 in retail product and of consumer outbreaks would be to go upstream in the process and introduce microbial interventions that are known to work across the board on all organisms, such as gamma irradiation (expensive technology) or antimicrobial chemicals (less expensive, easy to introduce by both large and small processors). At least reducing the incidence of all organisms on the product, including *E. coli* O157:H7, would reduce such illnesses and not depend on the hit-or-miss of current testing programs for *E. coli* O157:H7 to eliminate contaminated samples from the market place. In my opinion, consumers would be better served if we would implement interventions that we already know work.

***Note:** For the layperson, *E. coli* in general are beneficial bacteria that we all have in our intestinal tracts. However, among the thousands of strains and serotypes of *E. coli*, a few of them such as *E. coli* O157:H7 are infrequently associated with cattle and infrequently end up in raw ground beef. The problem addressed above, in my opinion, is the incidence in raw ground beef is so low that it most often will escape traditional testing. Therefore, would not the implementation of intervention strategies that actually reduces bacteria on product upstream in the process (during slaughter or further processing) be more beneficial to public health than rely on testing? Further, the current testing requirements will most often catch the smaller processor because its testing represents a high sample-to-lot size proportion than that of the larger processors it receives product from.