

Weighing the Evidence

Part II. It's How We Feed Cattle That Leads to E coli O157:H7 Shedding, Right?

By Dale A. Moore

Granted, there are different ways to raise cattle for beef. You've heard the terms "feedlot, natural, organic, grass-fed..." Each method of raising a beef animal has its rewards... and some folks have touted *their* way of raising beef as being "healthier", "better", "more sustainable"... and "less likely to result in *E coli* shedding"... Although it would be fun to discuss all the other issues, we'll focus on just the "*E coli* shedding" issue here.



What's the evidence for different ways of feeding cattle and their effects on *E coli* O157:H7 shedding? We know that cattle that shed this bug in their manure and that shedding can be responsible for the start of a cascade of events that can lead to contaminated food for people. But first, we'll start with cattle food.

What started us thinking that feeding cattle had anything to do with *E coli* O157 shedding? Well, it began back in the late 1990's – not too long ago when you think about it – a study done by a research group in New York showed that switching from a high concentrate (read – higher grain) diet to a higher roughage (read hay) diet reduced the population of *acid-resistant E coli* in the manure of cattle in their study (go to: <http://www.news.cornell.edu/releases/Sept98/acid.relief.hrs.html> for the press-release). These researchers looked at TOTAL GENERIC *E coli*, and not, specifically *E coli* O157:H7. But, their press release extrapolated to *E coli* O157:H7 because they knew that this particular bacterium was an acid-resistant type. Talk about VIRAL! Their

research has been reported on and the results talked or blogged about thousands of times. Every time we hear about an outbreak of *E coli* O157:H7 in people or a meat recall, somebody mentions that feeding grain to cattle and putting cattle back on "real cattle food" like hay or grass would solve the problem of *E coli* O157:H7 shedding and meat contamination.

But whoa just a minute! Can we really hang our hat on the results of one study? The New York research was not totally unfounded, though, because another research group at the University of Idaho had been looking at the diet of sheep and effects on the concentration and duration of shedding (in the manure) of our bacterium of interest. Let's take a look at the research that has been done since 1998 to examine, in more detail, the effects of cattle diet on *E coli* O157:H7 shedding in their manure.

Our research group found a wealth of literature on different ways of feeding cattle and the impacts on *E coli* O157:H7 shedding. For a detailed summary of all the feeding research up to 2011, see:

<http://extension.wsu.edu/vetextension/ec/Pages/Factsheets.aspx>.

Before we begin our cow-diet-to-manure journey -- I want to explain how we came up with the statements and questions we will address with “the evidence” from the review of the research publications. We did an “environmental scan” of the Internet and kept a “Google Alert” on *E coli* for about 18 months to help us see what major questions, and perhaps misconceptions, there were about cattle diet and our mysterious “bug”. So we examined blogs and news reports concerning *E coli* and came up with a list of common questions.

“I’ve heard that Grass fed cattle have less O157 than feedlot cattle?”...

Although many people have “reported” that pasture-fed beef cattle have less O157 than feedlot-raised cattle, two research studies could find no difference in the percent of cattle with manure samples positive for O157 between the two very different feeding systems. Another study found that range cattle were likely to become infected *before* they were weaned, so they may pick the “bug” up in the environment BEFORE heading to the feedlot.

“But it’s grain feeding (compared to hay feeding) that’s really the problem, right?” We mentioned the New York study that said grain-fed cattle would have more acid-resistant *E coli* and we said that they



only looked at GENERIC *E coli*. We need to remember that *E coli* are not *E coli*. A number of studies have looked specifically at *E coli* O157:H7 and the effects of forage versus grain feeding. The results are MIXED. Some studies showed a longer duration of O157 shedding on FORAGE diets and at higher levels than GRAIN-fed cattle. Like the Idaho study of sheep – they found a HIGHER CONCENTRATION of *E coli* and a LONGER DURATION of shedding in sheep on the FORAGE diet. Or – researchers have seen no significant difference in shedding of our bug from cattle fed grain- versus forage-based diets.

How can research have MIXED results? Let’s give an example. You might remember that back in 2008, a report in US News & World Report discussed newer evidence that some multivitamin supplements might NOT be healthful but actually HAZARDOUS (<http://health.usnews.com/health-news/blogs/on-men/2008/02/29/multivitamins--a-health-hazard>). The report noted that a series of earlier “observational” studies done in the 1980’s showed that antioxidants (like some vitamins) could protect against heart disease and cancer but that subsequent research using a different method of research (randomized clinical trials) showed those studies to be *wrong* and that the vitamin supplements either had no effect or, in high doses, could potentially cause harm.

Thus is the nature of science. We need to gather evidence from a number of studies before making a final decision and we have to consider the [LEVEL OF EVIDENCE](#) before making decisions. If we look at the basic premise of hypothesis testing (or the “scientific method”), we start with the [Null Hypothesis](#) – by saying that we do not believe there is a “difference” and we test that by trying to REJECT that hypothesis – We might say, “Oh look! The thing we measured (like the number of *E coli* O157:H7 per gram of manure) is really likely to BE DIFFERENT!” Why we might see MIXED results from similar studies has to do with HOW we measure our intended outcome, HOW MANY samples we take, HOW WE TAKE those samples, and any other factors that could affect our result. Scientists try hard to make sure that their studies are REPEATABLE by outlining how they did their study in the MATERIALS and METHODS sections of their research papers, but – NATURE IS COMPLEX – and we can only control for things we know about. Let’s continue to look at feeding practices and what published research has shown.

“Well, if feeding grain causes acid-resistant E coli, we can still say that pasture-fed is better!” Not so fast! A number of investigators found that grain-fed cattle have more *generic* acid-resistant *E coli*, but, when they looked specifically at O157, the results are MIXED. In general, O157 populations tend to be acid-resistant, regardless of the kind of diet the cattle are on. This is different than the generic *E coli* isolated from manure. So, grain feeding does not seem to be an issue with selecting for acid-resistant O157.

“What happens if we switch grain-fed cattle to a hay-based diet BEFORE they go to slaughter?” Researchers have found reductions in GENERIC *E coli* when you switch cattle to a hay-based diet. Unfortunately, we have little evidence for this diet switch and the effects on O157. We found two published studies: one reported a reduction in shedding prevalence and one found no difference. Perhaps we need a little more evidence, but this strategy could have some potential in reducing shedding. In addition, FASTING cattle (withholding feed for 1-2 days) before they go to slaughter appears to have mixed results – from no difference to actually INCREASING shedding.

“Corn is the enemy. Feeding corn to cattle increases O157 shedding.” Actually, a larger proportion of cattle fed barley-based diets shed O157 compared to those fed mostly corn diets in two studies. Even increasing the processing of corn before feeding it (by steam-flaking or cracking to make it more digestible) did not result in increases in O157. But, again, we could sure use a little more evidence on this matter.

We’ve heard it from a number of people that *“If you just feed cattle ‘cattle food’ and not ‘un-natural’ feeds we could reduce this problem.”* It is true that cattle are fed a number of different [“by-product”](#) feeds – things that cattle can digest and use the nutrients from, but people cannot. Many things that we can feed to cattle could end up in land-fills without this route (the cattle digestive system) of utilization. Two types of by-products feeds, whole cotton-seeds and by-products of distillation (fuel ethanol and alcoholic beverage production), have been put into cattle diets and evaluated for their effect on O157 shedding.

Whole cottonseed added to a cattle diet actually REDUCED the odds of finding O157 or did not have an effect on shedding. When it comes to products of distillation, wet distillers’ grain and dried distillers’ grain put into cattle diets appears to INCREASE shedding. This finding was substantiated in several studies.

So – is it easy to say that what we feed cattle influences *E coli* O157:H7 shedding? Not really. Nature is complicated. We have some evidence to help us make decisions about some cattle feeding practices but not all of them. And some of the “facts” that some people tout are really not grounded in the evidence. For a review of all the feeding practices and their effects on *E coli* O157:H7 shedding, see our factsheet summary at: [Published Literature on Dietary Components that Influence STEC O157 Fecal Shedding in Cattle](#).

It’s all about the evidence. Before we convict, let’s get as much evidence as we can.

WSU Extension programs and employment are available to all without discrimination. Evidence of noncompliance may be reported through your local WSU Extension office.