

Food poisoning bacteria *Campylobacter* and *Salmonella* reduced in broilers fed diets supplemented with enzyme

by Dr Milan Hruby, Technical Services, Manager, Danisco Animal Nutrition

Two enzyme products used widely in the poultry industry to improve the digestibility of wheat- and corn-based diets have been found to have additional effects on the numbers of bacteria in the gut of broilers that cause food poisoning in humans. These additional enzyme effects are brought about through an increase in the rate of diet digestibility, which significantly changes both the substrate quality and quantity available to the bacteria in the bird's gut.

The products are Avizyme* 1300 (which contains the enzymes xylanase and protease and is recommended for wheat-based diets) and Avizyme 1500 (which contains amylase, xylanase and protease and is recommended for corn-based diets). Both are widely used by poultry integrators and feed manufacturers to improve feed efficiency.

However, trials at an internationally acknowledged centre of excellence for veterinary research have shown that when these products are used at recommended commercial rates, they also promote an environment in the intestine that is unfavourable for the food poisoning bacteria *Campylobacter* and *Salmonella*.

This is good news for poultry producers who are looking to incorporate additional practical measures into existing management programs to minimize the occurrence of *Campylobacter* and *Salmonella* in production systems.

The need for such integrated programs has been highlighted by the results of tests carried out by health experts in

many countries that show that poultry carcasses often test positive for these harmful bacteria.

For example, an investigation in Canada during 1998/1999, where 57 broiler production units were tested for the presence of *Campylobacter*, found that 67 per cent of the units tested positive for *Campylobacter***.

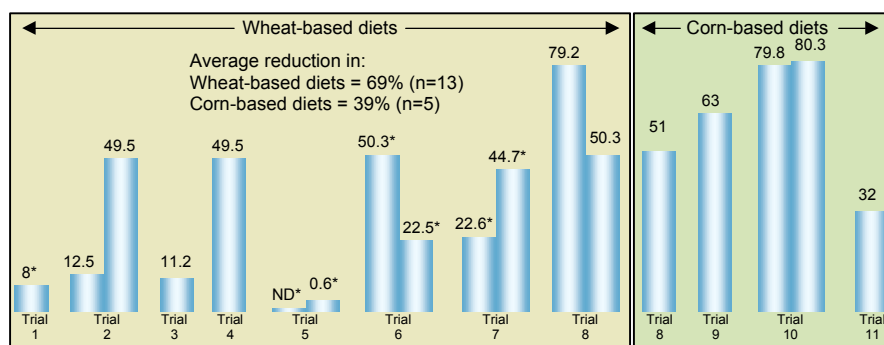
The trials with the Avizyme products were carried out as part of a joint research project between the

recommended dose rates of the appropriate Avizyme product, but excluding antibiotic growth promoters (AGPs) or coccidiostats (see Table 1.)

In the trials investigating *Campylobacter*, broiler chicks were challenged orally with the bacteria at four or five days of age, and population numbers in different parts of the intestinal tract were measured between 12 and 33 days of age.

In the eight wheat-based trials, there

Figure 1: The results of an Avizyme and *Campylobacter* trial
Campylobacter jejuni levels in the caecum of broilers
- Avizyme treatment compared to the control (%)



*P<0.05; ND = not detected
Data for birds inoculated with = 10⁶ colony forming units (cfus)

Department of Clinical Veterinary Science at the University of Bristol, UK and the manufacturers of Avizyme — Danisco Animal Nutrition (formerly Finnfeeds).

The Ross birds used in the project were fed on commercial diets based on either wheat or corn, plus the standard

was, on average, a two-thirds reduction in the number of *Campylobacter* found in birds fed the Avizyme 1300 supplemented diet, and in the four corn-based trials there was a reduction of over a third in birds fed the Avizyme 1500 treated diet, compared with the control (see Figure 1).

In the trials investigating *Salmonella* the broiler chicks were challenged orally with the bacteria at one day of age, and population numbers in different parts of the intestinal tract were measured between 14 and 17 days of age.

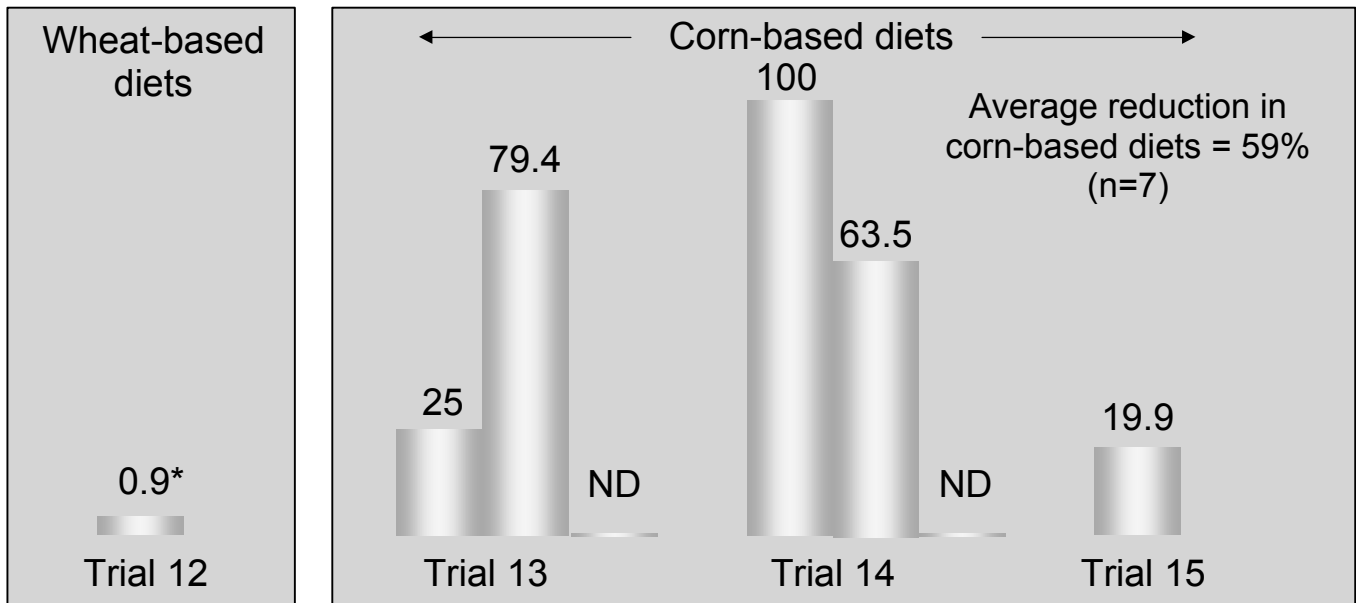
In the three corn-based trials, there was, on average, a reduction of almost 60 per cent in the number of *Salmonella* found in birds fed the Avizyme 1500 treated diet and a significant reduction in the number of *Salmonella* found in birds fed the Avizyme 1300 treated wheat-based diet (see Figure 2).

What this means in commercial practice is that fewer birds are likely to test positive for *Salmonella*. These studies found that significantly fewer birds fed the Avizyme treated corn-based

Table 1: Trial diets

Ingredients (kg/tonne)	Wheat diet	Corn Diet
Wheat	546.3 - 547.3	-
Corn	-	541.5 - 542.5
Soybean meal 48%	348.9	376.7
Soy oil	42.6	17.5
Tallow	20.0	20.0
Salt	3.8	4.1
DL Methionine	1.7	1.5
Limestone	12.2	12.2
Dical Phosphate	13.5	15.5
Vit/Min premix	10.0	10.0
Avizyme 1300 (wheat) or 1500 (corn)	+/- 1	+/- 1
Calculated analysis		
ME, kcal/kg (MJ/kg)	3050 (12.78)	3050 (12.78)
Crude protein, %	22.50	22.50
Lysine, %	1.20	1.31
Methionine, %	0.50	0.50

Salmonella enteritidis levels in the caecum of broilers Avizyme treatment as compared to that of the control (%)



*P<0.05; ND = not detected

Data for birds inoculated with = 10⁶ colony forming units (cfus)

Figure 2: The results of an Avizyme and Salmonella trial

diets tested positive to Salmonella, when compared with the control (see Figure 3).

These results appear to be linked to the three key modes of action of the Avizyme products in the gut of poultry:

1. A reduction in intestinal viscosity associated with wheat — resulting in increased feed passage rate, which means that there is less substrate available to support the harmful bacteria.

2. An increase in nutrients digested by the bird - resulting in fewer nutrients for the growth of harmful bacteria.

3. An altered carbohydrate profile in the intestine — resulting in more of the substrate preferred by beneficial bacteria e.g. Lactobacillus.

So, as well as having a positive effect on the growth rate and feed efficiency of the birds, the additional effect is to

reduce the amount of substrate available for the development of potentially harmful bacteria in the gut.

According to Dr Fresie Fernandez, who carried out the trials at the University of Bristol, the effect of the Avizyme products on bacteria numbers "represents a useful addition to the management practices already available for ensuring food safety."

As a microbiologist, she is keen to emphasise that complete elimination of pathogenic bacteria from the gut is at present unlikely. "However, any reduction is an important step forward," she says.

There are plans to field-test the concept in commercial flocks.

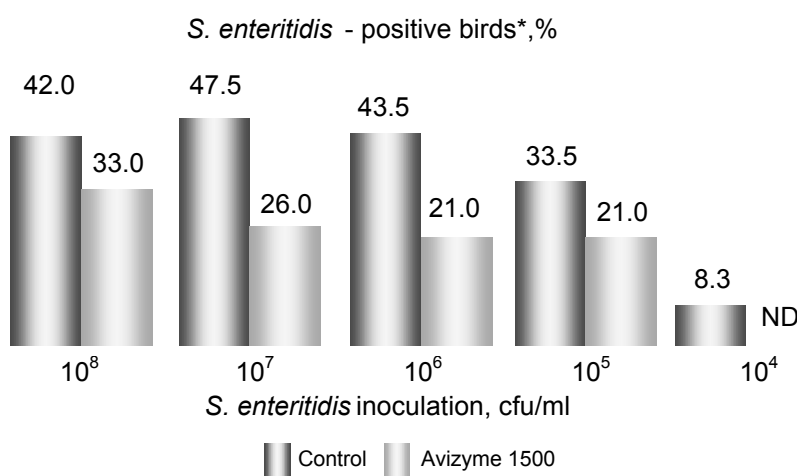
This shows that the commercial use of Avizyme products as supplements in the diet to improve feed efficiency can also offer benefits in terms of improved food safety due to improvements in diet digestibility.

*Avizyme is a registered trademark of Danisco Animal Nutrition

**Reference: Nadeau, E., Messier S., Quessy S., 2002. Prevalence and comparison of genetic profiles of Campylobacter strains isolated from poultry and sporadic cases of campylobacteriosis in humans. J. Food Prot. 2002 Jan; 65(1):73-78.

Keywords: Avizyme 1300, Avizyme 1500, Broiler, Corn, Digesta viscosity, Digestibility, Gut microflora, Microflora, Passage rate, Wheat, AGP, Zoonosis, Food safety, xylanase, amylase, protease, Salmonella, Campylobacter

Figure 3: The results of an Avizyme and Salmonella trial



Corn-based diet
Birds inoculated with 10⁴ to 10⁸ *S. enteritidis* at 1 day of age
*Defined as a bird with > 10⁵ cfu/g
ND = not detected