

Food poisoning bacteria reduced in diets with enzymes



by TC TAN and MILAN HRUBY*

Research conducted in the United Kingdom has shown that the use of in-feed enzymes significantly reduced the number of food poisoning bacteria in broilers.

Two enzyme products used 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 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 for wheat-based diets) and Avizyme 1500 (which contains amylase, xylanase and protease and is for corn-based diets).

Trials carried out by the Department of Clinical Veterinary Science at the University of Bristol, UK have shown that these products used at recommended commercial rates promote an environment in the

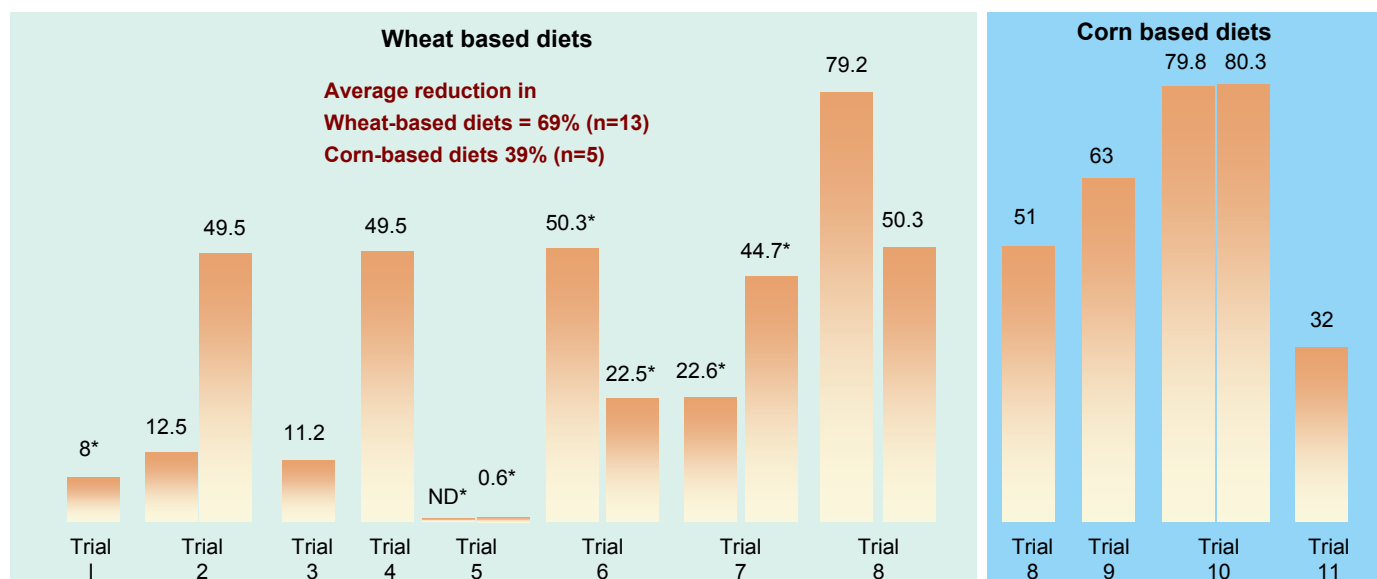
intestine unfavourable for the food poisoning bacteria *Campylobacter* and *Salmonella*.

This is of interest for poultry producers who are looking to incorporate additional practical measures into existing management programs to minimise the occurrence of *Campylobacter* and *Salmonella* in production systems. The need for such integrated programmes has been highlighted by tests carried out by health experts in many countries showing that poultry carcasses often test positive for these harmful bacteria.

For example, in Taiwan *Campylobacter* species (*C. jejuni* and *C. coli*) were found on 68% of whole chickens, 100% of chicken parts and 100% of organs from traditional retail markets (no chilling facility) in Taipei. Similarly, in supermarkets (with chilling facilities) 42% of whole chickens, 53% of chicken parts and 60% of organs were contaminated with *Campylobacter* species¹.

Figure 1: The results of an enzyme and *Campylobacter* trial.

Campylobacter jejuni levels in the caecum of broilers - Avizyme treatment compared to that of the control (%)



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

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In Japan, *Campylobacter jejuni* was found in 45.8% of retail poultry meat in a study conducted in Saitama. The study also suggested that *C. jejuni* spreads rapidly from one broiler flock to others².

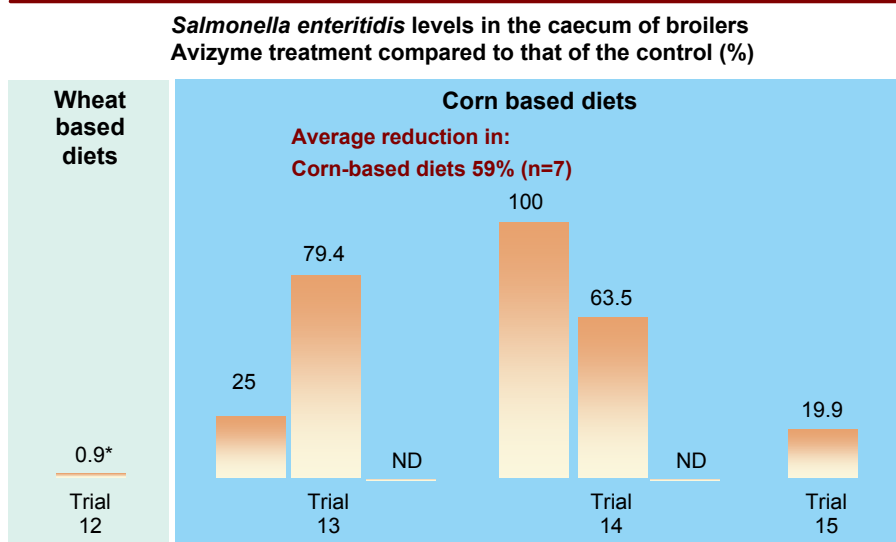
An investigation in the UK in 2000 found that 50% of all broiler carcasses tested positive for *Campylobacter*³ and an investigation in Canada during 1998/1999, where 57 broiler production units were tested for the presence of *Campylobacter*, found that 67% of the units tested positive for *Campylobacter*⁴.

Ross birds were fed on commercial diets based on either wheat or corn, plus the standard recommended dose rates of the appropriate enzyme product, but excluding antibiotic growth promoters (AGPs) or coccidiostats. Diets consisted of either wheat (55%) or corn (54%), soybean meal 48%, soy oil, tallow, salt, dl methionine, limestone, dcp, vitamins/trace minerals and the enzyme (+/- 1 kg/t). ME 3050 Kcal/kg, protein 22.5%, lysine 1.2-1.3%, and methionine 0.5%.

In the *Campylobacter* trials, broiler chicks were challenged orally with the bacteria at 4 or 5 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 was a two-thirds reduction in the number of *Campylobacter* found in birds fed the enzyme

Figure 2: The results of an enzyme and Salmonella trial.



supplemented diet, and in the four corn-based trials there was a reduction of over a third in birds fed the enzyme treated diet, compared with the control (figure 1).

In the *Salmonella* trials, the broiler chicks were challenged orally with the bacteria at 1 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 a reduction of almost 60% in the number of *Salmonella* found in birds fed the enzyme treated diet and a significant reduction in the number of *Salmonella* found in birds fed the enzyme treated wheat-based diet (figure 2).

This means in commercial practice

fewer birds are likely to test positive for *Salmonella*. These studies found that significantly fewer birds fed the enzyme treated corn-based diets tested positive to *Salmonella*, when compared with the control (see figure 3).

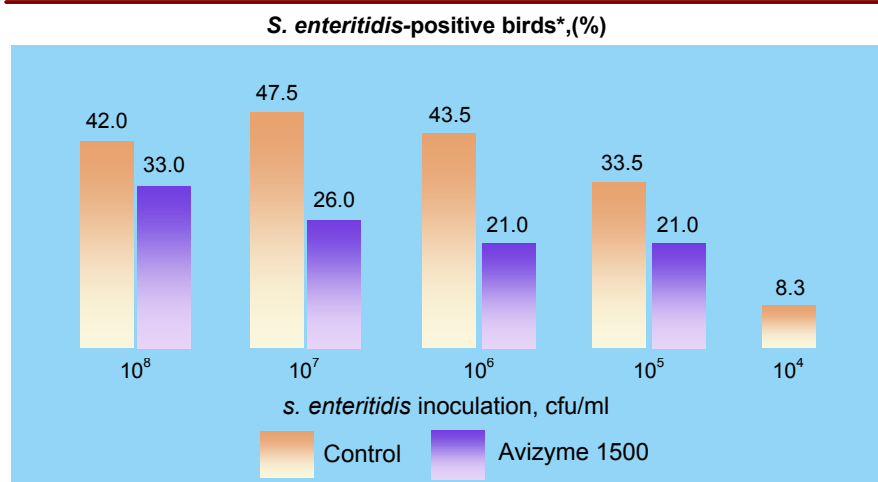
These results appear to be linked to the three key modes of action of the enzyme products in the gut of poultry:

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 the effect of these enzymes is to reduce the amount of substrate available for the development of potentially harmful bacteria in the gut. This represents a useful addition to the management practices already available for ensuring food safety. While complete elimination of pathogenic bacteria from the gut is presently unlikely, any reduction is an important step forward.

Commercial use of these enzyme 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. ■

Figure 3: The results of an enzyme and Salmonella trial.



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