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012 - Salmonella - III

Virulence factors

The pathogenicity of paratyphoid salmonella can be influenced by two types of toxin – endotoxin and enterotoxin.

The endotoxin is linked to the lipid A portion of the cell wall lipopolysaccharide of the salmonella bacterium. This endotoxin, if it gets into the bird's bloodstream when salmonella organisms are lysed (destroyed), is able to produce fever.

The lipopolysaccharide in the salmonella's cell wall also helps the salmonella organism to resist attack and digestion by phagocytes in the bird's immune system. If a salmonella can not synthesise complete lipopolysaccharide the ability of certain serotypes of salmonella, such as Salmonella typhimurium, to colonise the caeca and/or invade the spleen is impaired.

Toxins made from protein, known as enterotoxins, induce a secretory response by epithelial cells (cells lining the digestive tract and other systems) that results in a fluid accumulation in the intestine that can contribute to digestive upset or scouring.

Adherence and invasiveness

These two properties relate to a paratyphoid salmonella's ability to adhere to and then invade epithelial cells. These are the first two key stages in this bacterium's ability to cause disease. Serotypes of salmonella with a reduced ability to function in this way also tend to be among the weaker strains when it comes to producing disease.

The fimbriae and flagella on the surface of the salmonella bacterium play a role in this process and strains of S. enteritidis lacking such structures are also less able to adhere to epithelial cells and are poor colonisers of the caeca. Conversely, it has not been proven that fimbriae and flagella are essential for S. enteritidis to be able to colonise the bird's digestive tract.

What is important is the salmonella's ability to penetrate the lining of the digestive tract following adherence and the organism's adhesion and penetration properties are individually regulated. For example, mutant strains of S. enteritidis that are unable to colonise the bird's digestive tract are still virulent after intra-peritoneal administration.

Adherence and invasiveness properties of salmonella organisms can be influenced by laboratory cultural techniques and so one has to be careful in interpreting the properties of salmonella strains that have been multiplied up by cultural methods in the laboratory.

In addition, changes to the environment that a salmonella organism finds itself in, within the chick's digestive tract, can cause changes in the expression of virulence related genes. The full expression of pathogenicity appears to require multiplication of salmonella bacteria in the bird's cells.

Pathogenicity in different types

Different strains of paratyphoid salmonella differ significantly in their capabilities when it comes to causing disease. These differences are especially pronounced in the differences of strains to cause disease in chicks and to contaminate eggs. For example, only a limited number of strains are able to infect eggs via the transovarial route.

The ability to cause disease in chicks can also vary a lot within a single serotype and even within the same phage type.