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Avian Influenza XIV

Immunity

The innate immune response depends on factors present prior to the infection that are capable of responding quickly to an invading microbe. Innate immunity has four key components, namely:

- Physical and chemical barriers, such as skin, epithelia and the production of mucus.
- Innate cells, including macrophages, heterophils and natural killer cells.
- Complement proteins and mediators of inflammation.
- Cytokines.

Toll-like receptor family

Relatively recently the toll-like receptor family was discovered. These receptors are now known to be pattern recognition receptors (PRRs) which recognise evolutionary conserved molecular markers of infectious microbes known as pathogen associated molecular patterns (PAMPs). The innate immune response stimulates the adaptive immune response and influences its nature. That response is predicted by the type of cytokine response generated.

A T-helper 1 (Th1) response profile includes interferon-γ, IL-2, IL-7, IL-12, IL15 and IL-18 and is associated with very strong CD8+ T-cell antigenic specific responses, whereas a Th2 response includes Il-4, IL-5 and IL-10 to stimulate antigenic specific antibody production.

Typically, birds vaccinated against avian influenza with inactivated vaccines develop a Th2 response, whereas naturally infected birds show a balanced Th1/2 response.

Adaptive immunity – including humoral and cellular pathways – provides pathogen specific detection and requires more time to develop. For example, infection with LPAI produces virus neutralising immunoglobulin Y antibodies against the virus that block viral attachment and uncoating. However, antibody protection is only specific to a particular field virus subtype.

Humoral immunity is also hindered by the rapid mutation of avian influenza virus. A major consequence of vaccine induced immune pressure is rapid antigenic changes and the emergence of immunological escape mutants. In practice this means that vaccine seed strains must be regularly updated in order to retain vaccinal immunity.

Cell mediated immunity is a specific immunity that is mediated via T-lymphocytes and probably plays an important role in the development of protection in vaccinated birds. As intracellular viral replication is necessary for antigen processing, the protective antigens do not have to be localised on the surface of the virus. The benefits of a secondary cellular response have been shown to produce a decrease in viral shedding in terms of duration and viral quantity, which reduces the transmission potential and decreasing severity of disease.