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IgY-Technology: Production and Application of Egg Yolk Antibodies

Basic Knowledge for a Successful Practice

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Applications of IgY in Veterinary Medicine 15

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Abstract

Animal health and welfare is under constant threat from pathogenic organisms and there is need to move from the use of antibiotics as a first line of defence. The oral administration of IgY antibodies constitutes a powerful passive immune strategy and has been used in terrestrial and aquatic animals. The prevention and treatment of gastrointestinal diseases, particularly diarrhoea from different infectious agents in livestock and dogs, is one of the most studied uses of IgY for passive protection. The use of IgY for the treatment of calves, adult cattle, pigs and poultry is described. One of the major factors impacting on the productivity

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of aquaculture is the outbreak of disease and there is a need for development of treatments suitable for an aqueous environment. IgY used in the treatment of dogs is also expanding. Finally, the use of IgY in the detection of disease is outlined.

Keywords

Veterinary medicine · Aquaculture · Prophylaxis · Therapy · IgY product

15.1 Introduction

The focus of this chapter is on the use of IgY for passive immunization of food producing livestock, poultry and companion animals such as dogs. Currently, it is evident that a pandemic such as corona virus has the potential to disrupt agriculture and food supplies (Jámbor et al. 2020); therefore the control of disease in animals and fish assumes even greater importance and the role of companion animals in human welfare is recognized.

There are two main drivers for higher production of food: the increase in the global population which is predicted to reach 9.7 billion by 2050; and the increase in per capita income in developing countries which is matched with an increased demand for protein (Davis and White 2020). Meeting these demands will require increased productivity and a reduction of losses while meeting the demands of climate change and limiting resources (Crute and Muir 2011). Together with the livestock and poultry, aquaculture is also likely to contribute to a greater share of food production (Bostock 2011). The relationship between companion animals, such as dogs and cats and human wellbeing is well documented. It is estimated that 11.5 million dogs are owned as pets in UK and that there are similar levels of ownership in Europe, China, Japan and Australia (Brooks et al. 2018); there were notable increases in dog ownership during the pandemic of 2020 and a positive impact on loneliness during the lockdown (Oliva and Johnston 2020).

Intensive animal rearing systems are open to cross-infections with subsequent negative impacts on growth or even large-scale death of infected animals. The use of antibiotics which are relatively cheap and easy to administer has been implicated in the development of antibiotic resistance in humans (Barton 2000). Vaccination plays a major role in animal protection against a range of pathogens including bacteria, viruses and parasites (Hedegaard and Heegaard 2016). However, vaccines are seen to be ineffective in very young animals due to interference from maternally-derived antibodies and for protection from enteric infections (Hedegaard and Heegaard 2016). An alternative to both the use of antibiotics and vaccination, is passive immunization where immunoglobulins (Ig) from a donor are administered to a recipient to provide immediate immunity and short-term protection (Fig. 15.1).

The source of Ig is not important and as reviewed by Hedegaard and Heegaard 2016 (Hedegaard and Heegaard 2016), bovine colostrum, horse serum and IgY have been licensed for use in ruminants, horses and pigs. Several strategies have been