‘Investigation of the diagnostic value of ELISAs using colostrum derived immunoglobulins for targeted production animal diseases’

by

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Abstract

Due to the process of colostrogenesis, maternal antibodies are selectively transferred from the serum and are concentrated in the colostrum. The concentration of IgG in cow colostrum can be up to 10 times greater in concentration compared to serum, while the concentration of IgG in the sow and the ewe may be up to 2.5-3 times greater than serum. In dairy cows and sows in farrowing crates, the collection of colostrum is simple and non-invasive. Following fractionation of colostrum into whey and curds, the concentrations of Igs in the whey are often higher than in the colostrum. Due to these higher concentrations of Igs, colostrum and colostrum whey may improve the diagnostic utility of antibody ELISAs used for the diagnosis of important infectious production animal diseases.

There are a number of commercially available antibody-ELISAs for important production animal diseases. These tests are inexpensive and easy to perform, and are used extensively. Tests with a high sensitivity correctly identify a higher proportion of infected animals within a population, increasing the assurance of absence or presence of disease. Tests with a low sensitivity correctly identify a lower proportion of infected animals, increasing the incidence of false-negative test results.

This thesis investigated the diagnostic value of colostrum derived immunoglobulins for targeted production animal diseases. Using vaccinated animals, the diagnostic sensitivities of commercially available ELISAs for erysipelas (Erysipelas rhusiopathiae) and enzootic pneumonia (Mycoplasma hyopneumoniae) in pigs, Bovine Viral Diarrhoea Virus in dairy cattle and Johne’s disease (Mycobacterium avium subspecies paratuberculosis) in sheep were determined when using colostrum compared
to serum. Additionally, the diagnostic specificity was also determined for Bovine Viral Diarrhoea Virus in dairy cattle using samples collected from an unvaccinated, bulk tank milk negative herd. The diagnostic utility of the ELISA for Johne’s disease was also further investigated using samples collected from a dairy cattle herd with a history of previous infection.

A model using sow disease-specific antibody levels for the prediction of piglet serum disease-specific antibody levels was also developed, as well as the use of colostrum in ELISA for the detection of heifers carrying a calf persistently infected (PI) with Bovine Viral Diarrhoea Virus. The relationship between rennet dilution and IgG concentration in colostrum whey and the benefit of oral rennet supplementation during the neonatal period on the serum globulin concentration of piglets was also investigated.

Overall, the diagnostic sensitivities of the ELISAs were improved when using colostrum compared to serum, whilst also maintaining diagnostic specificity. Sow colostrum and serum were useful predictors of piglet serum disease-specific antibody levels, while colostrum collected from heifers carrying PI calves had significantly higher disease-specific antibody levels. The experiments that explored the coagulation potential of rennet were unable to demonstrate any improvements in Ig concentrations.

Colostrum may be a useful sample type for the detection of other important livestock diseases. The sensitivity of the ELISA for bovine tuberculosis when using serum is too low for control policies to be effective, while the analytical sensitivity of the ELISA for Neospora caninum when using bulk tank milk could still be improved.
Declaration of Originality

I certify that this work contains no material that has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission for any other degree or diploma in any university or tertiary institution without the prior approval of the University of Adelaide and, where applicable, any partner institution responsible for the joint award of this degree.

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Caitlin J. Jenvey
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