Final report

Executive Summary
Product development of an Australian trichomoniasis vaccine: Pilot trial

Project code: P.PSH.1368

Prepared by: Ala Tabor, Gry Boe-Hansen, Michael McGowan, Kieren McCosker
Tony Cavallaro

The University of Queensland

Date published: 31st January 2023

PUBLISHED BY
Meat & Livestock Australia Limited
PO Box 1961
NORTH SYDNEY NSW 2059

This is an MLA Donor Company funded project.

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

Abstract

Trichomoniasis is a venereal disease of cattle recently confirmed to be prevalent in northern Australian beef herds (approximately one in ten culled bulls were infected). Although a 'vaccine' was developed by CSIRO researchers in Australia in the 1980s, it was not commercialised because trichomoniasis was not considered to be widespread in southern Australia, especially in dairy herds. However, since the adoption of *Tritrichomonas foetus* quantitative PCR methods approximately 12 years ago (McMillen & Lew, 2006), an abattoir study demonstrated that one in ten bulls culled across abattoirs in northern WA, NT and northern Qld are *T. foetus* qPCR positive. This recent development indicates that trichomoniasis is prevalent in northern beef herds and the development of an Australian vaccine has become a research priority. This study aimed to evaluate an Australian sourced *T. foetus* killed vaccine in a pilot trial (n=6 bulls) to demonstrate efficacy and safety of vaccination of beef bulls against trichomoniasis. Two vaccine doses of inactivated strain TfOz5 in Montanide adjuvant were administered a month apart followed by live challenge using strain TfOz-N36 two weeks later. A second challenge was undertaken 4 months after vaccination to half of the bulls. An experimental efficacy of 67% was demonstrated with all vaccinated bulls showing *T. foetus* antibody responses. Recommendations for future trials include 2-3 challenges 3-4 days apart to better mimic what would be happening in a mating herd. In addition, the use of the vaccine as a treatment in 10 bulls yielded inconsistent results with five remaining qPCR positive. These results underpin the development of a larger project to test younger bulls, dosage requirements and adjuvants which will lead to a new bovine trichomoniasis vaccine for northern beef industries.

Executive summary

Background

Bovine trichomoniasis causes infertility in northern Australian herds and a recent abattoir survey demonstrated that one in ten cull bulls are infected with *Tritrichomonas foetus*. It has become a research priority to develop an Australian trichomoniasis vaccine. Research undertaken in Australia in the 1980s demonstrated an efficacious vaccine, however commercialisation did not occur as the impact of trichomoniasis in Australia was thought to be negligent. The pilot trial undertaken in this research will be considered as vaccine for application in northern Australian beef herds.

Objectives

1. *Identify a conserved Australian strain of Tritrichomonas foetus (TfOz) for vaccine development*. A culture collection of northern Australian *T. foetus* isolates was established at UQ and a Qld strain was selected for the vaccine strain and an NT strain as the challenge strain. The genomes were sequenced showing a high conservation of DNA between the two strains showing conservation between the two regional isolates selected.
2. *Develop scaled up culture methods of TfOz and complete a small pilot trial to confirm safety and efficacy of vaccine in bulls*. In vitro culture conditions were established and pilot trial using two doses of the experimental vaccine was used in six bulls. A 67% vaccine efficacy was determined following challenge.

Methodology

Long read genome sequencing was used to confirm conservation of strains selected for this study. Strain TfOz5 was grown for 2 days at 30^{o}C, centrifuged and inactivated by heating to prepare doses at 4 x 10^7 cells adjuvated with Montanide ISA 61 VG as recommended by the manufacturer. The cull bulls (aged 4-8 yo) were vaccinated one month apart and challenged 2 weeks later with 4 x 10^7 cells of TfOz-N36 strain. As not all control bulls were positive post challenge, a second challenge (8 x 10^7 cells) was administered 4 months after the second vaccination. ELISA was used to screen the bulls demonstrating antibody responses in the vaccinated bulls.

Results/key findings

Ninety-nine percent genomic conservation was demonstrated between two Australian *T. foetus* isolates originating from NT and Qld respectively.

A 67% efficacy of the experimental vaccine was demonstrated using tropically adapted bulls aged 5-8 years.

Benefits to industry

The preliminary trial demonstrates the ability to develop an Australian *T. foetus* vaccine for use in northern Australian bulls.

The application of a trichomoniasis vaccine will lead to increased fertility in northern beef herds

Future research and recommendations

A moderately sized trial (50-60 bulls) is recommended to test vaccine dosages and adjuvants to improve the product and to demonstrate efficacy in more bulls. It is also recommended to use <2 year old bulls.