Haemophysalis longicornis (bush tick) infestation reduces the responsiveness of calves to vaccination

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Vaccination is a vital tool in controlling infectious diseases of livestock, but several host factors, including disease, nutrition, management, and genetics, can impact the ability of cattle to respond to vaccines. If animals have an unsuccessful vaccine response, they are unlikely to be protected from infection during their lifespan. Ticks, as vectors of disease, modulate the host's immune system which facilitates pathogen spread but is also likely to impact responsiveness to vaccines. This study investigated how infestation with *Haemaphysalis longicornis* (bush tick) impacts vaccination response in dairy calves. Six-month-old Holstein Friesian cross calves were infested with 200-300 nymphal bush ticks for six days (contained underneath a calico patch) whilst under conventional grazing conditions. They were vaccinated with Pestigard® on the first day of tick infestation and received a booster two months later. Blood samples were collected at 0, 6, 12, 56 and 70 days post primary vaccination to assess immune responses. Age-matched tick-free 'control' cattle were utilised as a comparison. Calves infested with ticks exhibited significantly reduced antibody responses to both primary and booster vaccinations ($p<0.05$), with between 4 to 8 times lower circulating IgG levels compared to tick-free controls. Moreover, their circulating immune cells showed reduced ability to proliferate in response to the primary vaccination ($p<0.001$). This reduced vaccine responsiveness in tick-infested calves, persisting up to 70 days post-infestation, poses a significant threat to disease control in the Australian dairy industry. This discovery importantly highlights the interplay between multiple factors that impact vaccine efficacy and gives us a target to improve responsiveness. Through understanding why vaccines may fail we can Improve host responsiveness to vaccination, reduce the losses associated with vaccine preventable diseases and improve animal welfare.

Additional keywords: Bush tick, vaccine, antibody, Pestigard, cattle