Effects of subclinical *Theileria orientalis* Ikeda genotype infection on average daily gain ratios and a satisfactory rating in the breeding soundness exam in bull test stations in Virginia

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Introduction

Theileria orientalis Ikeda genotype is a tick borne hemoprotozoan that typically causes economic losses in dairy and beef cattle in Australia, New Zealand and Japan. Acute clinical infections from *T. orientalis* Ikeda include anemia, icterus, ill-thrift and death. The acute phase of the infection has been associated with decreased libido in dairy bulls, decreased live weight gain in beef bulls and increased mortality in naïve adults and calves. A sequela to acute infections within a herd is persistent subclinical infections, which have been associated with decreased mean daily gain in suckling beef calves. In late 2017, *T. orientalis* Ikeda was detected in beef cattle from multiple counties in Virginia and was associated with anemia, weakness, late term abortions and death. As of 2022, *T. orientalis* Ikeda has been identified in beef cattle in 31 of 95 Virginia counties. Beef production, typically in naturally bred cow-calf operations, is the second largest agricultural commodity in Virginia. Central bull testing programs for performance evaluation and marketing of beef bulls has existed for over 60 years in Virginia. *T. orientalis* Ikeda was first detected at the Southwest bull test station in 2020 when screened at conclusion of the test. The objective of this study was to determine if subclinical infection with *T. orientalis* Ikeda affected the average daily gain (ADG) ratios of all bulls on test and the achievement of a satisfactory rating of the breeding soundness exam (BSE) for senior bulls.

Materials and methods

Bull intake at the Southwest station occurs in October every year and evaluation is concluded in February. In 2020, bulls were tested for *T. orientalis* Ikeda on exit (n = 121) while in 2021 (n = 198) and 2022 (n = 221) bulls were tested on intake and exit. The Culpeper test station runs from July to November within the same year with 118 bulls were tested on intake and exit in 2021. A whole blood sample was collected from the tail vein for *T. orientalis* Ikeda testing upon intake and exit. The bulls are weighed regularly throughout test, with a BSE performed on senior bulls at the conclusion of the test. For the *T. orientalis* Ikeda testing, DNA was extracted from the whole blood sample for quantitative polymerase chain reaction (qPCR) analysis for *T. orientalis* Ikeda. Cycle count thresholds of < 40 indicated a positive for *T. orientalis*, further qPCR tests confirmed the T. orientalis Ikeda genotype. The ADG ratios were compared using a 2-tailed Student's T-test. ADG ratios were used instead of ADG to account for expected breed differences. The relative risk (RR) of achieving a satisfactory BSE with *T. orientalis* Ikeda infections was determined using a Chi-square contingency table.

Results

At the Southwest bull test, there was no significant difference in ADG ratio when comparing bulls infected at the end of test, for junior ($P = 0.25$, 102.1 ± 14.4 positive, 99.4 ± 16.1 negative) or senior ($P = 0.76$, 101.4 ± 18.0 positive, 100.5 ± 22.1 negative) bulls. For the Culpeper test station, there was no significant difference in ADG ratio ($P = 0.5$), comparing positive (100.6 ± 13.3) to negative (98.8 ± 13.5) bulls. Additionally, in test years with available intake and exit data, there was no significant difference in ADG ratio between the bulls that became positive during the test window compared to those that remained negative (Culpeper $P = 0.9$, Southwest $P = 0.9$).

We compared the BSE results and at the Southwest station, positive Southwest senior bulls have a 1.09 RR [CI: 0.87-1.34] and positive Culpeper bulls have a 1.06 RR [CI: 0.83 – 1.37] of achieving a satisfactory status.

Significance

Though many facets of *T. orientalis* Ikeda infection in the U.S. have not yet been determined, this research provides evidence that subclinical infection with *T. orientalis* Ikeda in bulls at Virginia bull test stations does not negatively affect the average daily gain ratio for junior or senior bulls, or a satisfactory rating of the breeding soundness exam in senior bulls.

