Validation of an automated cell counter to determine leukocyte differential counts in neonatal Holstein calves

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Introduction

Morbidity and mortality in calf rearing facilities is known to be high early in the production cycle causing large amounts of antimicrobials to be used for group metaphylaxis after arrival. With recent work focusing on identifying risk factors and biomarkers associated with mortality risk in calves arriving at veal facilities, it may be possible to reduce antimicrobial use after arrival by selectively treating only high risk calves. For a selective antimicrobial therapy protocol to be implemented without a decline in animal health and welfare, further refinement of calf risk assessment is required to increase the sensitivity and specificity of risk status determination. Rapid, on-farm white blood cell differential counts presents an opportunity to improve disease risk assessment in young calves when interpreted with clinical exam findings. The objective of this prospective cross-sectional diagnostic accuracy study was to validate an automated leukocyte cell counter, the QScout BLD test (Advanced Animal Diagnostic, Morrisville, NC), in its ability to determine leukocyte differential cell counts in neonatal Holstein calves.

Materials and Methods

A total of 240 calves were enrolled upon arrival at an independent grain-fed veal research facility in Ontario, Canada from June to July 2018. Calves received a risk assessment upon arrival to the facility using a standardized screening protocol (adapted from Renaud et al., 2018a) and blood samples were collected in EDTA anticoagulant for machine and manual leukocyte differential cell counts. Of the 240 calves eligible for enrolment, 5 were removed for missing leukocyte differential cell counts or invalid calf identification numbers. Machine leukocyte differential cells count were evaluated by the QScout BLD test (Advanced Animal Diagnostic, Morrisville, NC) and manual leukocyte differential cell counts were evaluated by microscopy at the Animal Health Laboratory at the University of Guelph (Ontario, Canada). Lin's Concordance Correlation Coefficient was used to measure the agreement between the QScout BLD test and manual differential tests using Stata 15 (StataCorp LP, College Station, TX).

Results

The leukocyte differential tests had very good agreement between tests for neutrophil counts rho = 0.83 (p-value < 0.0001); fair agreement for lymphocyte counts rho = 0.32 (p-value < 0.0001); fair agreement for the ratio of neutrophils to lymphocytes rho = 0.36 (p-value < 0.0001); slight agreement for monocyte counts rho = 0.14 (p-value < 0.0001); and, slight agreement for eosinophil counts rho = 0.20 (p-value < 0.026). Test results were further examined to determine if they differed in their classification of samples as being above, within, or below reported 95% reference intervals for neonatal Holstein calves (Panousis et al., 2018). Classification between tests resulted in very good agreement for neutrophils and lymphocytes with only 4.2% and 5.8% disagreement in classification, respectively. Moderate agreement for monocytes was observed with 23.3% classified differently; and, poor agreement was observed for eosinophils with 70.3% classified differently between tests.

Significance

The automated cell counter (QScout BLD; Advanced Animal Diagnostic, Morrisville, NC) performed well in estimating neutrophil differential counts, fair for lymphocyte and N:L ratio counts and had slight agreement for monocyte and eosinophil counts. Total leukocyte counts and N:L ratios in combination with clinical exam findings have potential to augment or refine calf risk assessment protocols. Further study is required to determine the role of the leukocyte profile in risk assessment of calves arriving at calf rearing facilities.