Anaemia in East African short-horn Zebu calves:
Field diagnosis, infectious causes and pathogen interactions

by

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SUMMARY

This study formed part of the collaborative IDEAL (Infectious Diseases of East African Livestock) project, which focused on the sedentary mixed crop-livestock smallholding system in Western Kenya. This was a longitudinal study where calves were recruited at birth and followed at 5-weekly intervals until 51 weeks of age. The main aim was to investigate the total disease burden of cattle in the study area for the first year of life.

The main objectives of the study concerned anaemia as a syndrome in the calves. Anaemia can provisionally be diagnosed based on clinical signs, but a confirmatory diagnosis is based on measuring of red blood cell parameters, such as packed cell volume (PCV), red cell counts (RCC) or haemoglobin (HGB). The FAMACHA© score card, a field diagnostic test developed to detect anaemia and haemonchosis in sheep, was designed to test pallor by measuring the colour of the ocular mucosa against a colour chart. The FAMACHA© as a field diagnostic tool was validated for use in East African short-horn Zebus, using PCV as the gold standard. The red cell parameters and indices as well as white cell and platelet parameters and indices of the East African short-horn Zebu were measured by a Sysmex® automated cell-analyzer.

The age-related changes in the haematological profile of East African short-horn Zebu were investigated. The haematological profile of the study population, particularly during the neonatal period, differed from reference ranges for European breeds, both in levels and age-related trends. These differences could not be explained by what is known about the physiology for other cattle breeds. Anaemia was a significant syndrome in the general study population based on the high incidence of anaemic episodes and the longitudinal trend in the general study population towards an anaemic state.

In a tropical environment calves are exposed to a myriad of pathogens, even from early calfhood, many of which potentially cause anaemia. The prevalence and cumulative incidence of pathogens, in particular tick-borne parasites, trypanosomes and intestinal parasites, was investigated. The variation in prevalence with age has allowed the identification of high-risk periods. The prevalence of co-infection of pathogens was also found to be considerable, in particular pathogens known to cause anaemia.

The relative contribution of different pathogens to the development of anaemia was investigated through their impact on the haematological profiles of calves infected by specific
pathogens. Strongyle-type nematodes and trypanosomosis were found to be the major causes of anaemia in the calves during their first year of life.

Co-infections with pathogens were shown to have a significant impact on the haematological profile of calves. In many cases the cumulative effect of, or interactions between concomitant pathogens affected the severity of clinical symptoms, such as anaemia, and in turn affected the prognosis of such calves. The impact of concomitant infections also complicates any diagnostic, treatment or intervention programmes in livestock and should be considered in any study on epidemiology in livestock kept under field conditions.
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LIST OF ABBREVIATIONS

AEZ: Zagro-ecological zone
AIC: Akaike’s information criteria
APC: Antigen presenting cells
AUC: Area under the curve
BIC: Bayesian Information Criteria
CI: Cumulative incidence
CV: Coefficient of variation
DC: Dendritic cells
DG: Dark ground buffy coat count technique
DVT: Department of Veterinary Tropical Diseases, University of Pretoria
ECF: East Coast fever
Eos: Absolute eosinophil count
ELISA: Enzyme-linked immunosorbent assay
EPG: Egg per gram faeces
HbA: Adult haemoglobin
HbF: Fetal haemoglobin
HCT: Haematocrit
HGB: Haemoglobin concentration
ICC: Intraclass correlation
Ig: Immunoglobulin A/E/G
IDEAL: Infectious diseases of East African livestock
IL: Interleukin
ILRI: International Livestock Research Institute
LR+: Positive likelihood ratio
Lymph: Absolute lymphocyte count
MCHC: Mean corpuscular haemoglobin concentration
MCV: Mean corpuscular volume
MPV: Mean platelet volume
Neut: Absolute neutrophil count
OD: Optical density
OPG: Oocysts per gram faeces
PCR: Polymerase chain reaction
PCV packed cell volume
PDW platelet distribution width
Plt platelet count
PP value percentage positivity
PV+ positive predictive value
PV- negative predictive value
RBC red blood cells
RCC red cell count
RDW red cell distribution width
RLBT reverse line blot technique
ROCR receiver operating characteristic curve
SD standard deviation
Ses sensitivity
SE standard error
SHZE East African short-horn Zebu
Sp specificity
TBD tick-borne diseases
Th-cells T-helper lymphocytes
TSP total serum protein
var variance
VAT variable antigen types in trypanosomes
VSG variable surface glycoprotein in trypanosomes
WBC white blood cells
WCC white cell count