

**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<sup>®</sup> 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<sup>®</sup> as a field diagnostic tool was validated for use in East African short-horn Zebu, 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<sup>®</sup> 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 calthood, 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 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	agro-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
Hb A	adult haemoglobin
Hb F	foetal haemoglobin
HCT	haematocrit
HGB	haemoglobin concentration
ICC	intraclass correlation
Ig A/E/G	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
mcr	microscopy
MHC	major histocompatibility complex
Mono	absolute monocyte count
MPV	mean platelet volume
Neut	absolute neutrophil count
OD	optical density
OPG	ooocysts per gram faeces
PCR	polymerase chain reaction



PCVpacked cell volume  
PDWplatelet distribution width  
Pltplatelet count  
PP valuepercentage positivity  
PV+positive predictive value  
PV-negativenegative predictive value  
RBCred blood cells  
RCCred cell count  
RDWred cell distribution width  
RLBTreverse line blot technique  
ROCreceiver operating characteristic curve  
SDstandard deviation  
Sesensitivity  
SEstandard error  
SHZEast African short-horn Zebu  
Spspecificity  
TBDtick-borne diseases  
Th-cellsT-helper lymphocytes  
TSPtotal serum protein  
varvariance  
VATvariable antigen types in trypanosomes  
VSGvariable surface glycoprotein in trypanosomes  
WBCwhite blood cells  
WCCwhite cell count