Differential white blood cell counts and survival in Ethiopian village chickens

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Microscope work in Debre Zeit laboratory

Introduction

- High plasma glucocorticoid increases circulating heterophil numbers and reduces circulating lymphocyte numbers
- This makes the heterophil/lymphocyte (H/L) ratio a useful tool for quantifying previous stress exposure in chickens
- Sources of stress known to impact the H/L ratio include pathogens, malnutrition, temperature or injury
- We hypothesised that differences in mortality in village chickens between two rural regions in Ethiopia may, at least in part, be associated with different levels of exposure to stressors
- This study aimed to investigate whether H/L ratio of birds sampled in two districts of the Oromia region of Ethiopia were associated with survival of village chickens

Methods

- Blood smears were made from fresh blood sampled from healthy adult chickens from two Ethiopian woredas in May (n=383) and October 2011 (n=384). Birds were rechecked 6 months later to determine if they had survived or died, either from disease or for another reason.
- Slides were air dried, fixed and stained using Wright-Giemsa Quick stain
- Manual differential cell counts were used to determine the proportion of leukocyte cell types. Cells were classified according to the following characteristics:

Two blood smears showing (a) heterophils and (b) lymphocytes as the predominant leukocyte type

Leukocyte types

Lymphocytes
- These are round cells with high nuclear to cytoplasm ratio
- There may be a narrow band of light blue cytoplasm, or it may be darker and more abundant in reactive lymphocytes
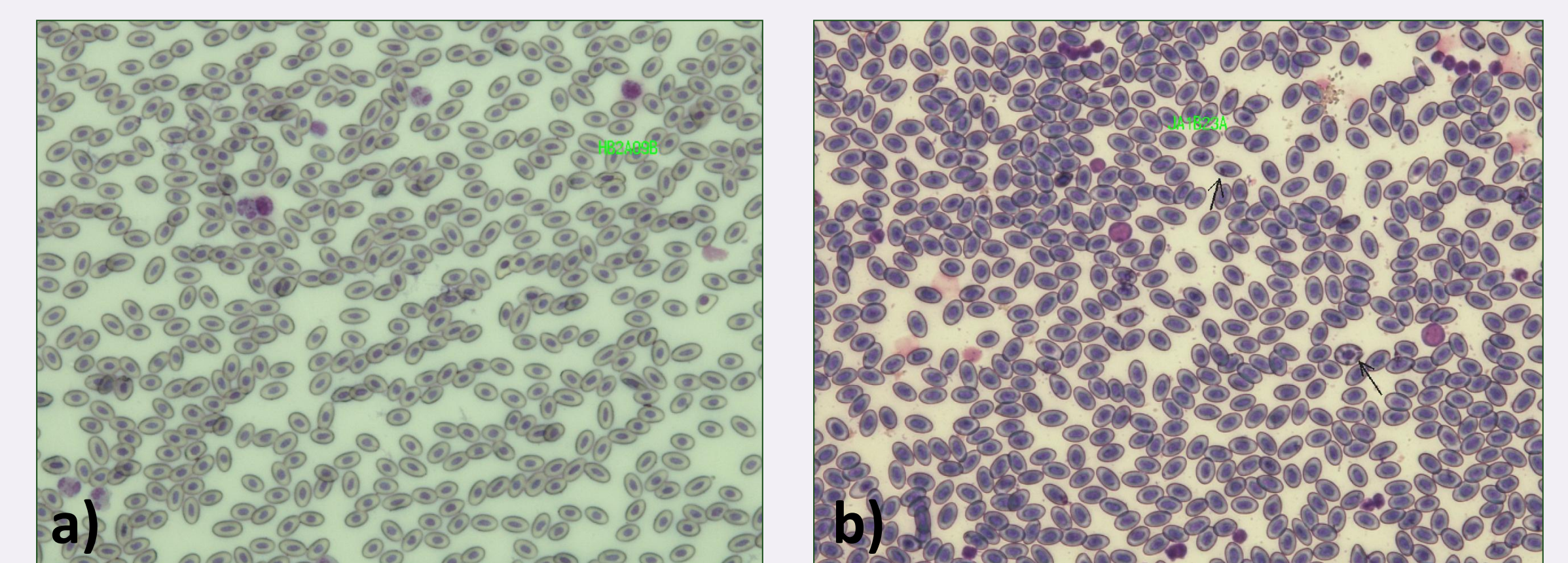
Monocytes
- These are large, round or irregular cells with a bean-shaped nucleus
- Cytoplasm is finely granular, blue-grey and may contain vacuoles

Heterophils
- These are analogous to neutrophils in mammals
- They have a lobed nucleus and rod-shaped granules

Eosinophils
- These have a lobed nucleus with clumped chromatin
- Granules are round, and tend to stain red

Cell types not included in differential count

Erythrocytes
- Bird erythrocytes are nucleated
- Immature erythrocytes tend to have more basophilic nuclei with clumped chromatin

Thrombocytes
- These are small, nucleated cells which function like mammalian platelets
- They have clear cytoplasm, and are easily mistaken for lymphocytes

Results

- Heterophils predominated in the majority of birds sampled in both regions in May, but this cell type was markedly lower in birds sampled in October.
- In Horro, H/L ratios were significantly higher in May compared to October, but in Jarso there was no significant seasonal difference
- In Horro, birds sampled in May were much less likely to survive over the wet season than those in Jarso.
- In both regions birds with high H/L ratios were at greater risk of subsequently dying from disease, but this risk reduced as birds became older (Fig. 1)
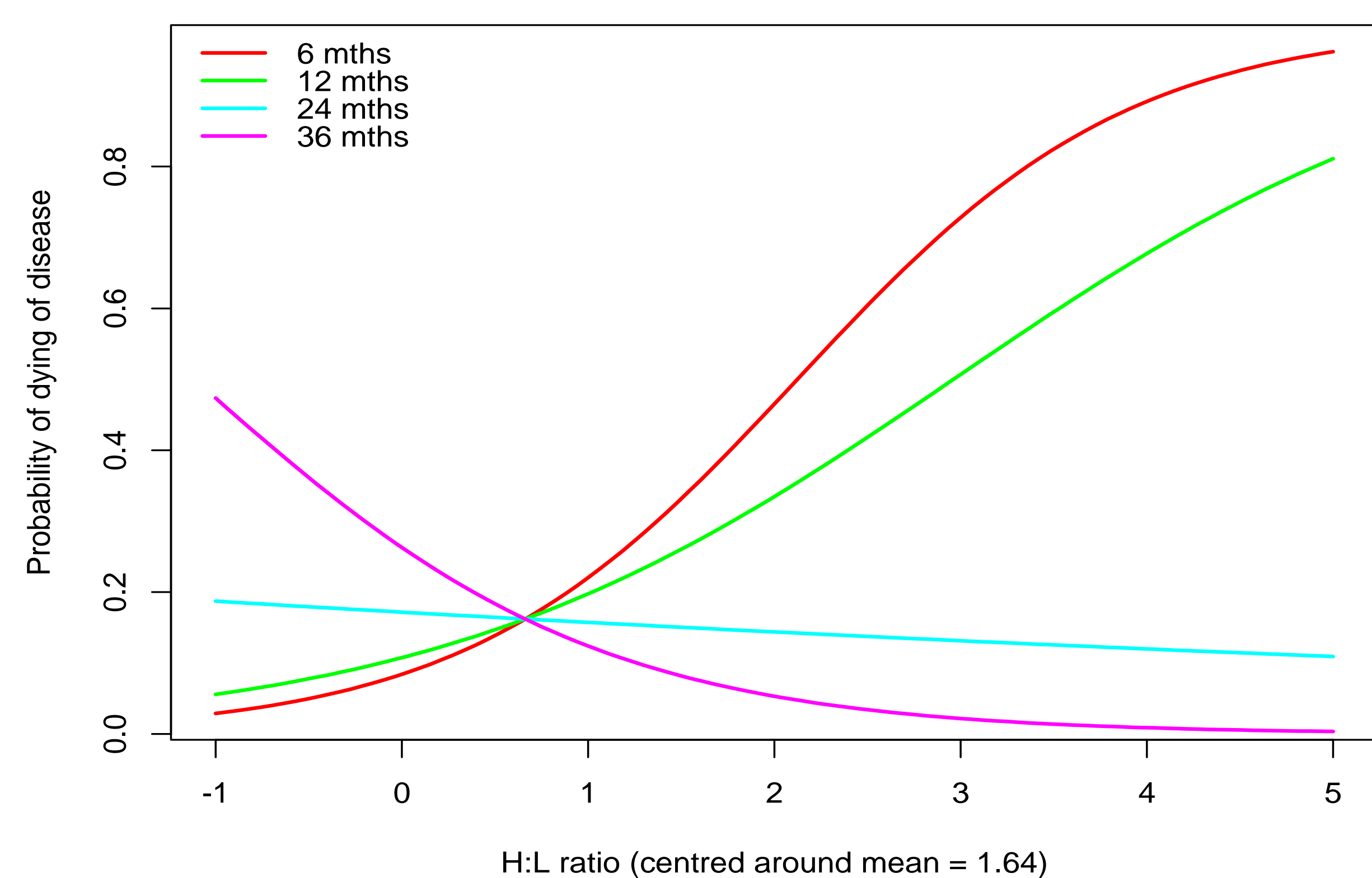
Fig.1 Interaction between age and H/L ratio on the risk of death from disease

Conclusions

- Chickens in Horro are reported to be at greater risk of dying of disease, especially over the rainy season, than those in Jarso.
- The significantly greater H/L ratios found in Horro birds in May, at the end of the dry season may be an indicator of recent stress, which makes them more susceptible to disease over the rainy season.
- Younger birds were found to be at particular risk of disease if they had high H/L ratios, which may reflect the fact they have had less opportunity to develop immunity to the local diseases than older birds.
- Further research is required to determine why H/L ratios differ so markedly. Potential stressors may include nutrition, environment or reproductive demands .