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Leucocyte Values in 1–6-day-old Calves of *Bos indicus* Crossbred and *Bos taurus* in a Tropical Environment

J. C. O'Kelly

Division of Animal Genetics, CSIRO,
Cattle Research Laboratory, Rockhampton, Qld 4700.

Abstract

Leucocyte counts were made on *B. indicus* crossbred and *B. taurus* calves aged 1–6 days. Calves were born in three adjacent paddocks in a tropical environment. Variations in the absolute counts of leucocyte components between animals were large and there were significant breed and age differences in lymphocyte counts. The proportions of lymphocytes increased ($P<0\cdot01$) and neutrophils decreased ($P<0\cdot05$) with age. Total leucocyte, lymphocyte, monocyte and neutrophil counts were significantly higher ($P<0\cdot001$) in calves of all breeds in one paddock than in the other two.

Introduction

There have been numerous reports of leucocyte values in both adult and young cattle from temperate and tropical countries. However, the literature shows considerable differences in mean leucocyte values and studies in Queensland (Granzien 1968) and Ireland (Ryan 1971) have clearly demonstrated that the assessment of lymphocytosis in temperate breeds of cattle in one country cannot be based on published work from another country.

Bos indicus cattle generally perform better than *Bos taurus* cattle in tropical areas and show more resistance to the cattle tick, *Boophilus microplus*, and gastrointestinal helminths (Turner and Short 1972). Yet few comparative studies have been made of the leucocyte values of these breeds grazing under the same tropical conditions, and there appears to be no comparative information on animals younger than one month.

The purpose of this investigation was to compare the leucocyte values in Zebu and British calves in their first week of life in a tropical environment.

Materials and Methods

All animals ran together and were maintained under field conditions at the National Cattle Breeding Station, 'Belmont', Queensland, as described by Kennedy and Turner (1959). The British animals were the progeny of matings of Shorthorn × Hereford and those referred to as Zebu were half-bred Brahman × British (Brahman cross) and half-bred Africander × British (Africander cross). Annual matings of bulls and cows took place in single sire groups for a period of 7 weeks. Several weeks before calving the grazing pregnant cows were herded at random into three adjacent paddocks called River, Pink Lily and Figtree so that all three breeds were represented in each paddock. The area has a variety of soils ranging from light sandy loams on the higher country of Figtree paddock to heavy alluvials on the lower country of flood-prone River paddock. The mean daily maximum and minimum environmental temperatures during the calving period were 33·5 and 20·5°C respectively.

Blood samples were taken from 18 groups of 4 calves selected at random from Africander cross, Brahman cross and Shorthorn × Hereford calves dropped over a 3-week period. Each sex of each

breed was represented by three groups of calves aged 1–2 days, 3–4 days and 5–6 days and one calf in each age group was born on the same day. There were thus 24 calves of each of the three breeds.

The blood samples were obtained by jugular venipuncture in the early morning from calves which had been rested for at least 1 h. For the total leucocyte counts blood was diluted with acetic acid coloured with methyl violet and the cells counted in a double-squared Neubauer chamber according to the method of Dacie (1958). Blood smears were stained by Leishman's method and the differential cell counts expressed as a percentage of 300 cells counted (Dacie 1958).

Results

The data were analysed into the following sources of variance: sex, breed, age and paddock. Because of the unequal numbers of animals in each cell the results were analysed by a non-orthogonal least squares analysis. Component cell types were analysed as the logarithm of number per cubic millimetre, not percentages.

Table 1. Means from least squares analysis of leucocyte counts in Zebu and British calves aged 1–6 days
Values are expressed in thousands per cubic millimetre. There were 24 calves per breed group

Parameter	Africander cross	Brahman cross	Shorthorn × Hereford	Age 1–2 days	Age 3–4 days	Age 5–6 days
Total leucocytes	7·86	9·40	7·84			
Lymphocytes	3·81	4·84*	3·62	3·48	3·80	4·98**
Monocytes	0·17*	0·29	0·29	0·29	0·26	0·25
Neutrophils	3·71	4·11	3·71	4·15	3·78	3·54
Eosinophils	0·10	0·08	0·15	0·11	0·11	0·11

* Mean significantly different from the other two breed means in the row at $P<0·05$.
** Mean significantly different from the other two age means in the row at $P<0·01$.

The means derived by least squares analysis of the leucocyte counts for the three breeds are shown in Table 1. Sex was without effect on any of the leucocyte components. The total leucocyte counts in Brahman cross calves were higher than those of the other breeds but the differences did not reach statistical significance. The lymphocyte counts were higher ($P<0·05$) in the Brahman cross and the monocyte counts were lower ($P<0·05$) in the Africander cross than in the other breeds. The lymphocyte counts were higher ($P<0·01$) on days 5–6 than on the other days (Table 1).

The leucocyte counts for calves in each of the paddocks are shown in Table 2. All leucocyte components except eosinophils were higher ($P<0·001$) in calves in River paddock than in the other two paddocks.

When adjusted to the same total leucocyte counts, the lymphocyte values were higher ($P<0·01$) and the neutrophil values lower ($P<0·05$) on days 5–6 than on days 1–2 but there were no significant breed or paddock effects on the differential white cell count. The percentages of lymphocytes and neutrophils were respectively 44·2 and 51·5 on days 1–2 and 59·1 and 38·2 on days 5–6.

Discussion

Granzien (1968) found that the variation of leucocyte values in temperate breeds of cattle in Queensland was much wider than those generally reported for similar breeds in other countries. An even greater range of leucocyte values in Zebu and British calves in their first week of life in a tropical environment is now reported.

Total leucocyte and lymphocyte counts in cattle increase between 1 and 12 months of age (Granzien 1968) and then decrease with age (Irvin 1967). This study has demonstrated a decreasing proportion of neutrophils and an increasing proportion of lymphocytes during the first week of life.

Table 2. Means, standard deviations and ranges of leucocyte values in Zebu and British calves aged 1–6 days in three adjacent paddocks

Values are expressed in thousands per cubic millimetre. The number of animals in each group is given in parentheses in the column headings

Parameter	River paddock (29)	Pink Lily paddock (20)	Figtree paddock (23)
Total leucocytes	21·58±22·61*** (15·85–45·67)	6·03±6·63 (3·20–9·70)	4·69±4·94 (2·40–6·60)
Lymphocytes	11·21±12·38*** (7·30–29·50)	2·96±3·44 (1·11–6·36)	2·24±2·38 (1·10–3·62)
Monocytes	0·63±0·89*** (0·14–2·05)	0·19±0·25 (0·02–0·55)	0·15±0·18 (0·04–0·33)
Neutrophils	9·49±10·17*** (6·54–18·43)	2·82±3·18 (1·38–4·87)	2·26±2·45 (0·96–3·82)
Eosinophils	0·20±0·30 (0·01–0·84)	0·06±0·09 (0·01–0·23)	0·04±0·05 (0·01–0·16)

*** Mean significantly different from the other means in the row at $P<0·001$.

Breed differences in circulating white cell counts have been found by some workers (e.g. Ryan 1971) but not by others (see Granzien 1968). In this study there was a random distribution of breeds in three paddocks and breed differences in the counts of leucocyte components were evident (Table 1). However, if the animals had been allocated to paddocks on a breed basis as in some managerial practices then the results (Table 2) indicate that the breed occupying River paddock would have shown leucocyte values significantly higher than the other breeds. It is clear that environmental effects must be considered for the establishment of valid breed differences, at least in a tropical area.

The cause of the apparent leucocytosis in calves in River paddock is unknown. Ticks are endemic to the area and it is possible that this paddock harboured more parasites than the other two. Infestations of mature ticks (*B. microplus*) on adult cattle produce an increase in circulating lymphocytes, a neutropenia and an eosinophilia (O'Kelly *et al.* 1971). The finding of a neutrophilia and the absence of a significant eosinophilia in calves in River paddock therefore argue against tick infestation. However, only the larval stage of ticks would normally be found on newborn calves and the effects of tick larvae on the white cell picture of calves have not been investigated.

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