SEASONAL VARIATION IN THE LEVELS OF SOME CHEMICAL AND HAEMATOLOGICAL COMPONENTS IN THE BLOOD OF WHITE FULANI COWS IN WESTERN NIGERIA

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SUMMARY

Haematological and some biochemical determinations were made on the blood of six White Fulani heifers monthly for a period of twelve months in order to investigate any normal seasonal variations in the levels of some of these components.

It was found that packed cell volume, haemoglobin and red cell count values were higher during the relatively dry months of the year than the wet months. These changes can possibly be explained by changes in the water content of the serum since body water content would decrease with decrease in water intake during the dry months resulting in haemoconcentration. Total leucocyte count, mean corpuscular haemoglobin concentration and total serum proteins tended to increase during the rains and were lower in the dry months, while there were no appreciable seasonal differences observed in the levels of mean corpuscular volume, mean corpuscular haemoglobin, inorganic phosphorus and calcium. However, mean corpuscular volume appeared to increase with increasing age.

INTRODUCTION

Seasonal variation in the levels of some blood constituents have been reported in the temperate climates and these variations have been attributed to changes in the environmental temperatures which vary markedly between the winter and summer months.

Increases in haemoglobin (Hb) and packed cell volume (PCV) levels were observed in the summer months or when calves were exposed to humid heat (Rusoff, Johnston, and Branton, 1954; Bianca, 1957; Patterson, Shrode, Kunkel, Leighton and Rupel, 1960). However, Weldy, McDowell, Van Soest and Bond (1964) reported a decrease in PCV with chronic exposure to heat (31.9--37.4°C). An increase in PCV was also observed in the blood of cattle in winter as well as in cold environment by Reeves, Grover, Will and Alexander (1962) and Olsen (1973) respectively.

Stufflebeam, Wilson, Mayer, Day, Comfort and Lasley (1964) on the other hand, noticed a general increase in PCV and Hb values under high or low temperatures. The same workers observed that total white cell count (WBC) appeared to be higher in the warmer months while the highest red cell counts (RBC) were obtained in the coldest months although there was no definite seasonal trend in the latter. Total serum proteins and inorganic phosphorus levels were reported lower in the winter than in the summer months but no definite seasonal trend was reported in calcium level (Brody, 1949); Stufflebeam et. al., 1964).

Since temperature changes during the year are not well marked in the hot humid tropics of Western Nigeria, the aim of this study was to investigate seasonal variations in blood constituents of cattle in the tropics and which environmental factor such variations, if any, could possibly be attributed to.

MATERIALS AND METHODS

Six healthy White Fulani heifers, about 18 months of age were used in the present study. They were housed in pens throughout the day except during grazing in the mornings. The animals received supplementary feeds such as brewer's grain, citrus pulp, silage and concentrate. Mineral lick and water were provided ad lib. The heifers were sprayed weekly

against ecto-parasites and treated regularly for gastro-intestinal worms. They also got Samorin (Isometamidium chloride) prophylactic treatment against trypanosomiasis twice a year.

These animals were bled twice a month for a period of 13 months starting from March 1975. On each occasion, two blood samples were obtained through the external jugular vein from each animal. One sample was collected into a universal bottle containing EDTA (ethylenediaminetetra acetate) as anticoagulant while the other sample was allowed to clot and serum extracted by centrifugation within two hours of collection.

The PCV was determined by the microhaematocrit method without correcting for trapped plasma and Hb was estimated by the cyanmethaemoglobin method (Benjamin, 1961). The RBC and WBC counts were performed using the improved Neubauer ruling haemocytometers while erythrocyte indices, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated (Schalm, Jain and Carroll, 1975). Total serum proteins were estimated as described by Reinhold (1953) while serum calcium and phosphorus levels were determined according to Trinder (1960) and Gomori (1942) respectively.

Climatological data were obtained from the Meteorological department, University of Ibadan for the period March 1975 to March 1976.

RESULTS AND DISCUSSION

Figure 1 shows the atmospheric temperatures in terms of monthly maximum and minimum temperatures. The maximum temperatures fell steadily from March through September and began to rise sharply after September until February 1976 when a peak was reached. The minimum temperatures did not show any particular pattern but the lowest temperature was recorded in August 1975,

The average monthly rainfall and relative humidity are shown in figure 2. The relative humidity increased gradually from March and reached a peak in July after which it decreased steadily. The rainfall was highest in April and then fell sharply until August. It then increased after August and a second peak was reached in October after which it fell sharply again.

Table 1 shows average values of the atmospheric conditions and various blood components at different periods of the year. Figures 3 and 4 show graphic representations of monthly variations in the blood constituents examined during the study.

Haematological Constituents:

There was much similarity in the pattern of seasonal variation obtained for some haematologic components including PCV, Hb and RBC values, although these seasonal variations did not follow any definite pattern. A greater variation occurred in PCV values during the period under study than in Hb and RBC values. The PCV decreased from March to May as rainfall and relative humidity increased. However, PCV values then increased steadily until August while rainfall decreased and relative humidity increased. There was a fall in PCV again in September and October during which rainfall rose sharply to a second peak in October. Thereafter, PCV increased and later decreased in value with a steady decrease in rainfall and relative humidity. The seasonal.

Fig.1. Average Monthly Temperature
1975 - 76

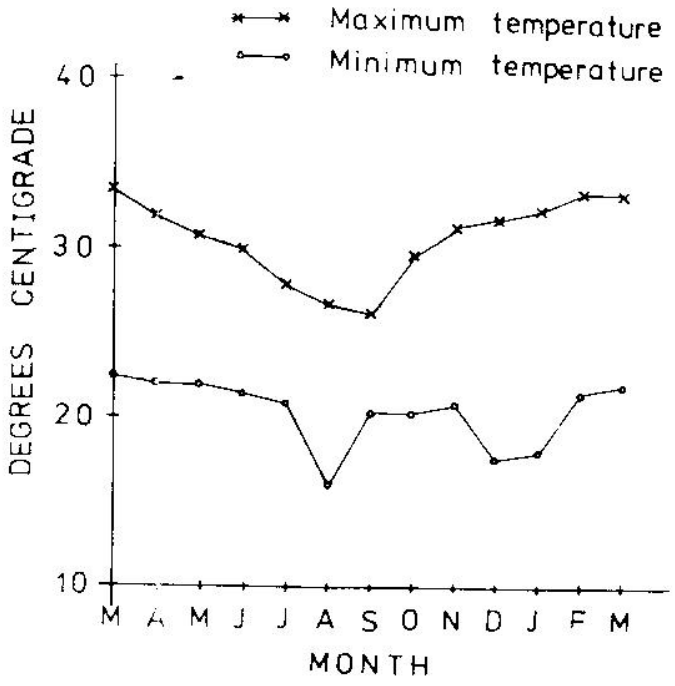

FIG.2. Average Monthly Rainfall and Relative Humidity
1975-76

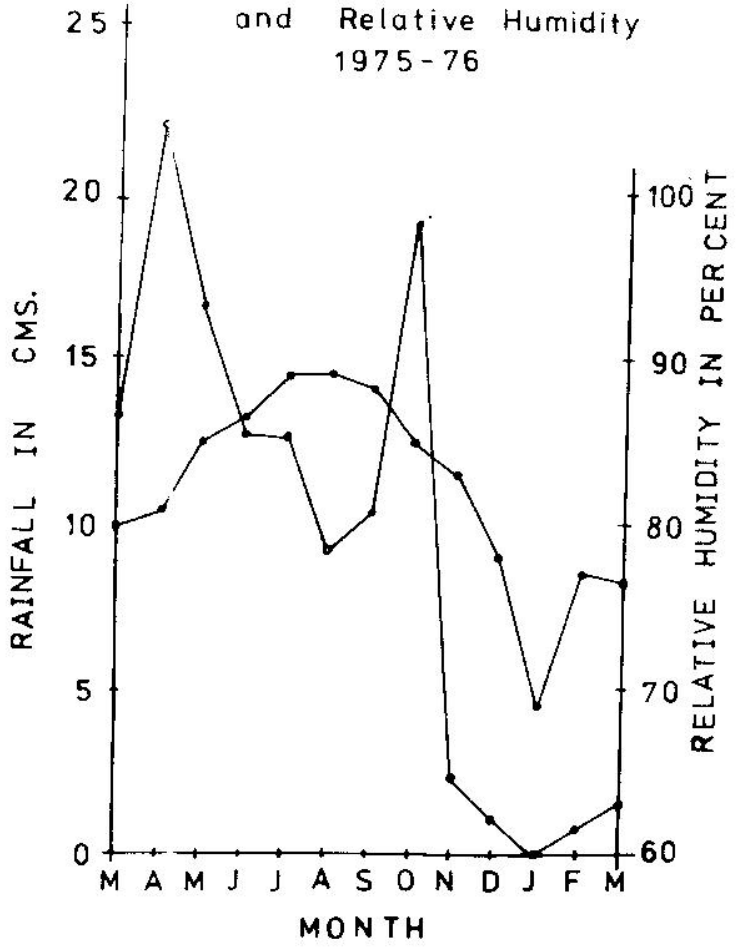

FIG. 3. Seasonal Variations in some Blood Constituents in Cattle

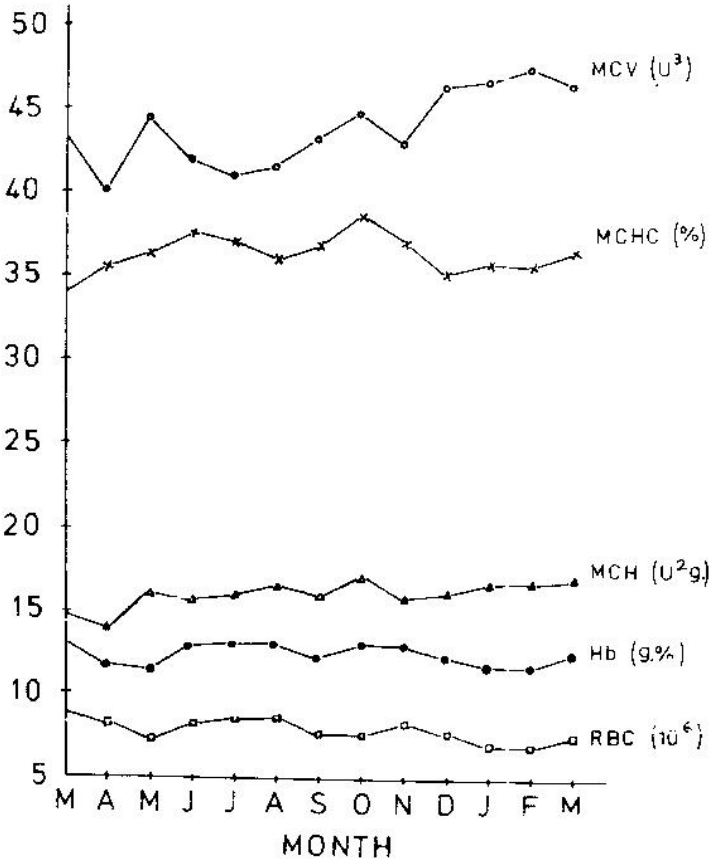

FIG. 4. Seasonal Variations in some Blood Constituents in Cattle

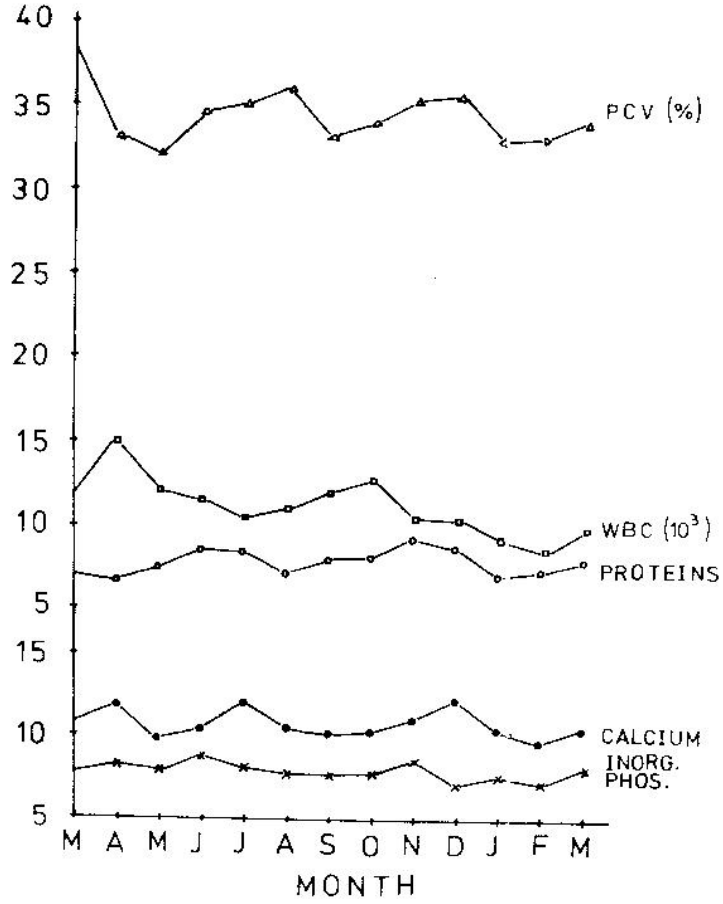

TABLE 1

Average Values of Atmospheric Conditions and Some Blood Components at Different Periods of the Year (1975—76)

	Mar—May	*Jun.—Aug.*	*Sep.—Nov.*	*Dec.—Feb.*
Rainfall (cms.)	17.30	11.55	10.54	0.38
Minimum temperature (°C)	22.16	19.43	20.51	19.07
Maximum Temperature (°C)	32.06	28.41	29.15	23.46
Relative Humidity (%)	82.00	88.00	85.30	74.66
PCV (%)	34.53	35.16	34.08	33.86
	(1.62)*	(1.77)	(2.32)	(1.87)
Hb (gm. %)	12.16	12.99	12.76	11.99
	(0.75)	(0.63)	(0.45)	(0.56)
RBC (10^6/cu. mm)	8.14	8.43	7.82	7.23
	(0.52)	(0.45)	(0.72)	(0.32)
WBC (10^3/cu. mm)	13.04	10.99	11.76	9.45
	(2.50)	(2.80)	(3.26)	(1.58)
MCV (U^3)	42.63	41.50	44.06	46.95
	(3.56)	(3.20)	(2.96)	(3.40)
MCH (U^2 gm.)	15.03	16.12	16.40	16.62
	(0.97)	(0.80)	(0.97)	(0.87)
MCHC (%)	35.32	36.85	37.44	35.44
	(2.01)	(1.45)	(2.11)	(1.56
Total proteins (gm. %)	7.02	7.45	8.11	7.01
	(0.50)	(0.52)	(0.48)	(0.51)
Inorganic Phosphorus (mg. %)	7.92	8.14	7.94	7.28
	(0.67)	(0.87)	(0.49)	(0.52)
Calcium (mg. %)	10.88	10.97	10.51	10.79
	(0.88)	(0.79)	(0.42)	(0.56)

* = Standard Deviation.

The seasonal changes in PCV was very similar to those of Hb and RBC. In general, it appeared that these components tended to be higher in the blood during the relatively dry months of the year than the wet months. This is in agreement with the findings of Saror and Coles (1973) who reported that PCV and RBC values were higher in the dry season although Hb was higher in the wet season. This could be explained by the changes in the water content of the serum and therefore the viscosity of the blood since total body water content is known to fall with a decrease in water intake which would occur in the dry months of the year (Siebert and Macfarlane, 1969). In other words, a low body water content would lead to haemoconcentration which therefore results in relatively high PCV, Hb and RBC values. The values obtained here for PCV, Hb and RBC are in agreement with those recorded for Nigerian cattle by Saror *et. al.* (1973), and Olusanya (1976a), although the RBC values are slightly higher than those reported by Saror *et. al.* (1973).

The WBC appeared to decrease with increasing age. It increased during the rainy months with the highest values obtained in April and October which corresponds with the two peaks in rainfall. This is in accordance with the findings of Saror *et. al.* (1973), and could be attributed to a higher worm infestation rate and therefore leucocytosis during the rains. The values obtained are generally higher than those obtained by Saror *et. al.* (1973) but are similar to those reported by Olusanya (1976a).

The MCV and MCH did not appear to show any seasonal trend but in general MCV seemed to increase with increasing age which confirmed the observation made by Stufflebeam *et. al.* (1964). MCHC, however, tended to increase with increased rainfall with the highest value occurring in October. Saror *et. al.* (1973)

however reported that MCV, MCH, and MCHC were higher in the wet season than the dry season of the year in northern Nigeria. The values obtained for these parameters are similar to those reported for cattle in Nigeria (Saror *et. al.*, 1973; Olusanya, 1976a).

The seasonal variations observed in PCV, Hb, RBC, WBC and MCHC were not found to be statistically significant after statistical analysis.

Chemical Constituents:

Total serum protein values increased slightly shortly after the rains and were lower during the dry months. Saror *et. al.* (1973) also obtained a slightly higher value during the wet season. This could be due to the fact that protein intake would increase during the rains as fresh green pasture would be more available during this period.

Serum inorganic phosphorus and calcium did not show any seasonal trend although the highest calcium value was recorded in the dry season. The values obtained for total serum proteins and calcium are generally similar to those obtained for Nigerian breeds of cattle although the serum inorganic phosphorus values are slightly higher (Saror *et. al.*, 1973; Olusanya 1976a).

In conclusion, since analysis of blood is an easy way to detect many pathological conditions in domestic animals before clinical symptoms show, it is essential to know the normal changes that occur in blood components due to seasonal variations. This will make it easy to interpret any changes resulting from pathological conditions rather than seasonal changes. This study has also shown that the seasonal trend in some blood components in the hot humid tropics could be better attributed to changes in rainfall and humidity during the year rather than changes in temperature.

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