

HORMONE LEVELS IN PERIPHERAL PLASMA OF THE AFRIKANER COW

II. PROGESTERONE AND TOTAL UNCONJUGATED OESTROGEN LEVELS DURING LATE GESTATION AND PARTURITION

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OPSOMMING: HORMOONPEILE IN PERIFERE BLOEDPLASMA VAN AFRIKANERKOEIE

II. PROGESTEROON- EN TOTALE ONGEKONJUGEERDE ESTROGEEN-KONSENTRASIE GEDURENDE LAAT-DRAGTIGHEID EN PARTURISIE.

Bepaling van progesteron- en totale ongekonjugeerde estrogeen-konsentrasies is deur middel van radioimmunologiese tegnieke op perifere bloedplasma van 4 Afrikanerkoeie tydens laatdragtigheid en parturisie uitgevoer. Progesteronpeile wat gewissel het tussen 8,4 en 13,0 ng/ml op dag 12-18 voor partus het geleidelik gedaal tot 3,7-8,2 ng/ml 1 tot 2 dae voor partus. Gedurende die daaropvolgende 12-24 uur het progesteronkonsentrasie skerp gedaal tot 1,2-2,0 ng/ml, 12-24 uur voor partus. Tydens parturisie en 24 uur daarna het progesteronkonsentrasie 'n opvallende styging getoon terwyl minimum peile (<1 ng/ml) 24-48 uur na partus bereik is. Individuele estrogeenpeile het vanaf 193-267 pg/ml 19-22 dae voor partus tot 'n maksimum van 453-687 pg/ml 3-5 dae voor partus toegeneem. Die daaropvolgende geringe daling tot 271-523 pg/ml onmiddelik voor partus is gevolg deur 'n skerp afname tot 96-145 pg/ml kort na partus. Twee dae na partus het estrogeenkonsentrasie op ongeveer 110 pg/ml gestabiliseer met weinige variasie tussen individue.

SUMMARY:

Progesterone and total unconjugated oestrogen concentrations in the peripheral blood of 4 Afrikaner cows during late gestation and parturition were determined by RIA. From 12-18 days prepartum, progesterone levels ranged from 8.4 to 13.0 ng/ml and subsequently declined to 3.7-8.2 ng/ml at 1-2 days prior to parturition. During the following 12-24 hours progesterone concentration dropped sharply to 1.2-2.0 ng/ml, these levels being measured 12-18 hours prior to calving. A moderate rise in progesterone levels not previously reported was observed during the subsequent parturition and 24 hours thereafter. Minimum progesterone levels (<1 ng/ml) were reached 24-48 hours post partum. Oestrogen levels ranging between 193 and 267 pg/ml 19-22 days prepartum increased consistently to 453-687 pg/ml at 3-5 days before parturition. Thereafter, levels declined slightly with the approach of parturition, and then dropped sharply from 271-523 pg/ml just prior to calving to 96-145 pg/ml shortly thereafter. Two days after parturition oestrogen concentration averaged 110 pg/ml with very little variation between individuals.

Introduction

Breed differences in gestation length are well-established in the bovine. The most striking differences are found when *B. taurus* and *B. indicus* breeds are compared. In the Afrikaner (*B. indicus* type) gestation length for male calves varies from 291,5 (Van Graan & Joubert, 1961) to 296,5 days (Skinner & Joubert, 1963), which is 4 to 16 days longer than the duration reported for most *B. taurus* breeds (Preston & Willis, 1970). In contrast to the numerous reports on the hormone levels during gestation and parturition in the latter breeds (Hunter, Erb, Randel, Garverick, Callahan & Harrington, 1970; Stabenfeldt, Osburn & Ewin, 1970; Hendricks, Dickey, Hill & Johnston, 1972; Edqvist, Ekman Gustafsson & Johansson, 1973; Smith, Edgerton, Hafs & Convey, 1973; Symons, 1973; Arije, Wiltbank & Hopwood, 1974; Agthe & Kolm, 1975; Chew, Keller,

Erb & Malvern, 1977) no information is available for either the Afrikaner or Brahman. The objective of the present study was to determine progesterone and total unconjugated oestrogen levels in the Afrikaner during late gestation and parturition and to compare these patterns with existing results.

Procedure

The present study was undertaken at the Vallharts Research Station, Department of Agricultural Technical Services. Blood samples were collected via jugular venipuncture into heparinized tubes from 4 purebred Afrikaner cows which were in their second to fourth preg-

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nancy. Samples were collected once weekly commencing approximately 3 weeks prior to estimated parturition, daily during the final week prepartum and every 12 hours from 3 days prior to, until two days after calving. Immediately after collection the blood samples were centrifuged and the plasma stored at -15°C until assayed. Plasma progesterone was determined by radioimmunoassay using an antibody raised against Progesterone-succinate while oestrogen (oestradiol $17\text{-}\beta$ and oestrone) was measured by the same assay technique using a 1:10000 dilution of antiserum W11 744. Both antisera were prepared by Dr J.C. Morgenthal, Department of Human and Animal Physiology, University of Stellenbosch. Coefficients of variation (c.v.) for the different progesterone standards (0–2000 pg) ranged between 1,24 and 2,40%. C.v. for oestrogen at 0, 100, 200, 300, 400, and 500 pg were 2,1 2,2 4,4 3,8 3,3 and 2,1% respectively. Determination of known progesterone quantities indicated that the assay procedure was sensitive enough to distinguish significantly ($P < 0,01$) between 0 and 500 pg/ml and between 500 and 1000 pg/ml.

Results and Discussion

Progesterone levels in the individual cows during late gestation and parturition are depicted in Fig. 1.

Progesterone concentrations fluctuated markedly, but tended to decline gradually over the period 12–18 until 1–2 days prepartum. Levels which ranged from 8,4–13,0 ng/ml declined to 3,7–8,2 ng/ml during the abovementioned period. The following 12–24 hours were characterised by a sharp decline in progesterone concentration, and levels of 1,2–2,0 ng/ml were measured 12–18 hours prior to calving. During parturition and until 24 hours thereafter a moderate and temporary rise in progesterone concentration was observed. Minimum progesterone levels of less than 1 ng/ml were measured 24–48 hours after parturition.

With the exception of the period during and immediately after parturition, the pattern of progesterone secretion in the Afrikaner was very similar to those described by Symons (1973), Smith *et al.* (1973) and Edqvist *et al.* (1973) for *B. taurus* breeds. The observation of elevated progesterone levels during and shortly after parturition could not be verified from other reports. The possibility that this phenomenon may be a breed characteristic requires further investigation. The source of this temporary progesterone increase was not established during the present study.

Total unconjugated oestrogens

Changes in the concentration of oestrogen towards the end of pregnancy and parturition are shown in Fig. 2.

Fig. 1. Progesterone levels in 4 Afrikaner cows during late gestation and parturition

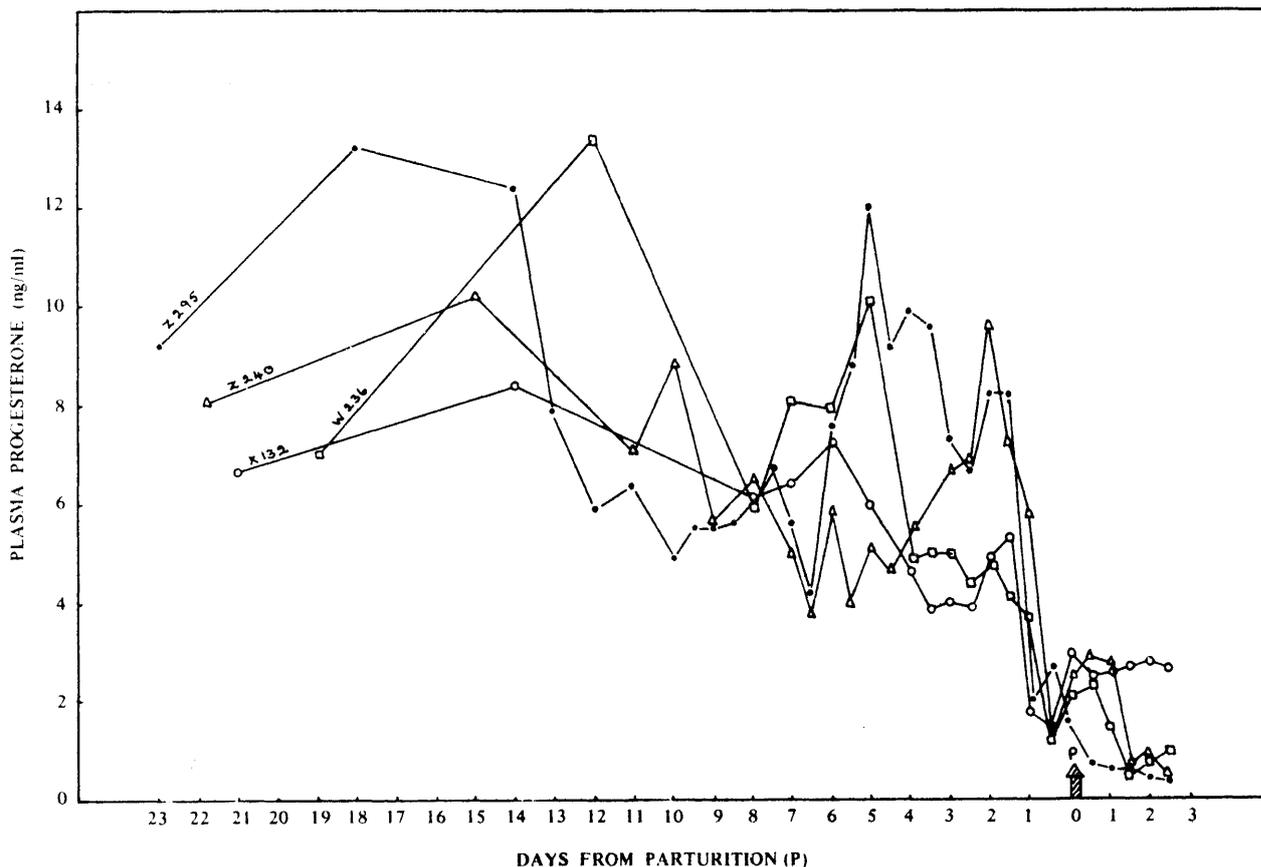
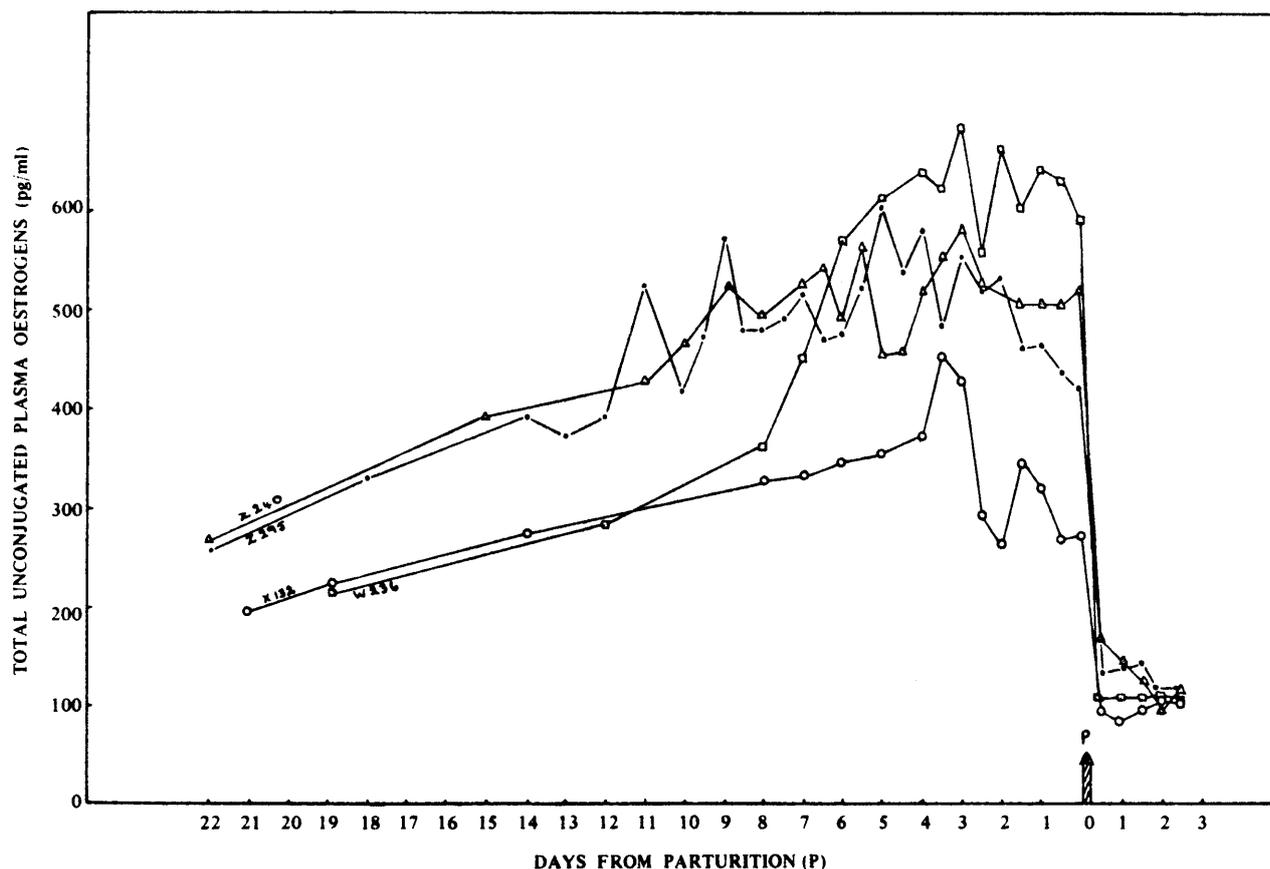


Fig. 2. Total unconjugated oestrogen levels in 4 Afrikaner cows during late gestation and parturition



From 19–22 days prepartum, oestrogen levels varied from 193–267 pg/ml and then increased consistently until 3–5 days before parturition, when levels ranging from 453–687 pg/ml were measured. At this stage hormone levels reached a plateau and appeared to even decline slightly with the approach of parturition. Oestrogen concentration varied between 271 and 523 pg/ml just prior to parturition and dropped precipitously to 96–145 pg/ml shortly thereafter. At two days post partum oestrogen levels stabilized at 110 pg/ml with very little variation between individuals.

These changes in hormone concentration are very similar to those reported by Robinson, Anastassiadis & Common (1971), Smith *et al.* (1973) and Peterson, Hunter, Welch & Fairclough (1975). These authors also reported that peak values occurred at least 2 days prepartum, as was found in the present study. In contrast Stellflug, Randel & Moody (1973), Robertson (1974) and Chew *et al.* (1977) described a continuous increase with the approach of calving, and measured maximum values immediately prior to parturition.

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