

HORMONE LEVELS IN THE PERIPHERAL BLOOD OF THE ARIKANER COW

III. PROGESTERONE LEVELS DURING THE *POST PARTUM* PERIOD

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OPSOMMING: HORMOONPEILE IN PERIFERE BLOEDPLASMA VAN AFRIKANERKOEIE
III. PROGESTEROONPEILE GEDURENDE DIE *POST PARTUM* – PERIODE.

Bloedmonsters van 5 volwasse, lakterende Afrikanerkoeie is daaglik vanaf kalwing tot die eerste daaropvolgende estrus ingesamel. Plasmaprogesteroonkonsentrasie is deur middel van radioimmunologiese tegnieke bepaal en is aangewend vir die evaluering van eierstok-aktiwiteit na kalwing. Die *post partum*-anestrusfase het gewissel van 57–77 dae tussen individue. Die grootste deel van hierdie anestrusperiode is gekenmerk deur 'n lae plasmaprogesteroonkonsentrasie (0,4–1,6 ng/ml). Alhoewel 'n styging in progesteronkonsentrasie enkele dae voor die eerste *post partum*-estrusperiode by al die diere waargeneem is, kon hierdie styging slegs in een geval aan 'n stilovulasie gekoppel word. In hierdie geval het die progesteronkurwe 'n noue ooreenkoms getoon met progesteronpeile soos gevind gedurende die luteale fase van 'n normale estrus siklus. Plasmaprogesteroontoename in die ander 4 koeie het min onderlinge variasie getoon en het toegeneem van 0,5–0,7 ng/ml, 6–8 dae voor estrus tot 2,1–3,0 ng/ml, 2–3 dae voor estrus waarna dit geleidelik afgeneem het tot 0,3–0,7 ng/ml tydens estrus. In hierdie 4 gevalle het die plasmaprogesteroontoename dus slegs 4–5 dae geduur teenoor die 20 dae na 'n stilovulasie.

SUMMARY:

Following parturition blood samples were collected daily from 5 mature lactating cows until the first *post partum* oestrous period. Plasma progesterone concentration as determined by RIA was applied to evaluate *post partum* ovarian activity. Parturition to first oestrus varied from 57–77 days between individuals. During the major part of this period, plasma progesterone concentration fluctuated between 0,4 and 1,6 ng/ml. Although an increase in plasma progesterone concentration prior to first oestrus was observed in all the cows, the occurrence of a silent ovulation was evident in only one of the cases. In this animal plasma progesterone levels exhibited the same pattern as described during the luteal phase of a normal oestrous cycle. In the 4 remaining cows progesterone levels increased from 0,5–0,7 ng/ml, 6–8 days before oestrus to 2,1–3,0 ng/ml, 2–3 days before oestrus, whereafter it dropped to 0,3–0,7 ng/ml at oestrus. The duration of these plasma progesterone increases lasted 4–5 days as compared to 20 days following a silent ovulation.

Introduction

In the lactating cow the *post partum* period is generally characterized by a anoestrous phase of variable duration (Baker, 1969; Wiltbank, 1970; Roberts, 1971). Although the length of the anoestrous period may be influenced by various managerial and physiological factors (Van Niekerk, 1975) it has been shown that the re-establishment of oestrus after parturition is preceded by variable follicular activity and that one or more ovulations often precedes the first standing oestrus (Morrow, Roberts, Mc Entee & Gray, 1966; Marion & Gier, 1968; Saiduddin, Riesen, Tyler & Casida, 1968). In order to ensure a 365-day intercalving period these changes are of prime importance especially with the fast increasing interest in, and application of, large scale AI and oestrous synchronization. As a prolonged anoestrous

phase is commonly observed in the lactating Afrikaner (Rose, Christie & Conradie, 1963; Harwin, Lamb & Bisschop, 1967; Coetzer, Mentz, Vermeulen & Coetzee, 1975) the present study was undertaken to investigate changes in *post partum* plasma progesterone as an indication of ovarian activity in this breed.

Procedure

Immediately after calving 10 mature Afrikaner cows were kept in small paddocks and fed good quality lucern hay *ad libitum*. Occurrence of oestrus was determined by daily observation and mounting by a vasectomized bull fitted with a chin-ball mating harness.

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Blood samples were collected daily from 5 of these cows between day 2 and 11 *post partum* and twice daily (every 12 hours) from 12 to 25 days *post partum*. The 5 remaining cows were bled daily from 25 days *post partum* until the first observed oestrus. Blood samples were collected from the jugular vein into heparinized tubes, centrifuged and the plasma stored at -15°C until assayed. Progesterone content of these samples was determined by radioimmunoassay as described previously (Coetzer, Van Niekerk, Morgenthal & Van der Westhuizen, 1977).

Results and Discussion

2-25 days *post partum*

During this period plasma progesterone concentration showed very little variation both within an between individuals. In 3 of the 5 cases a small plasma progesterone increase was observed between day 3 and 6 and again between day 8 and 10 *post partum* (Fig. 1, cow 198). During these periods, plasma progesterone levels increased from baseline values of 0.9-1.2 ng/ml to 2.0-2.9 ng/ml. With the exception of these small, temporary increases, progesterone concentration fluctuated between 0.4 and 1.2 ng/ml throughout the remainder of the period. Plasma progesterone content of the remaining two cows showed no prominent increases and varied between 0.4 and 1.6 ng/ml during the period 2-25 days *post partum* (Fig. 1, cow 160).

According to reports on dairy cattle by Morrow *et al.* (1966), Marion & Gier (1968) and Thatcher & Wilcox (1973) ovarian activity recommenced relatively early and, depending on various factors, the first *post partum* ovulation occurs between 13 and 20 days. Although blood samples were obtained twice daily during this phase in the present study, no indication of such early ovulation was observed in the Afrikaner. Plasma progesterone levels showed very little variation and mostly remained below 1 ng/ml during this phase.

25 days *post partum* to first oestrus

Although blood samples were obtained from 5 different cows during this phase, plasma progesterone levels showed a pattern similar to that found during the period 2 to 25 days after parturition (Fig. 1, cow 152, 307). First oestrus after parturition was observed between 60 and 77 days (Table 1.) These values correspond closely to the average anoestrous length of 58 to 62 days as determined by Mentz (1976, personal communication) and by personal observation of the Afrikaner under extensive conditions. Although the anoestrous period in beef cattle is highly variable (18 to 113 days) and depends mainly on factors such as suckling, level of nutrition, body condition, breed and age of cow and calving difficulties, many studies yielded an average anoestrous period ranging from 60 to 90 days *post partum* (Tervit, Smith & Kaltenbach, 1977).

Fig. 1. Plasma progesterone levels in the Afrikaner cow during the *post partum* period

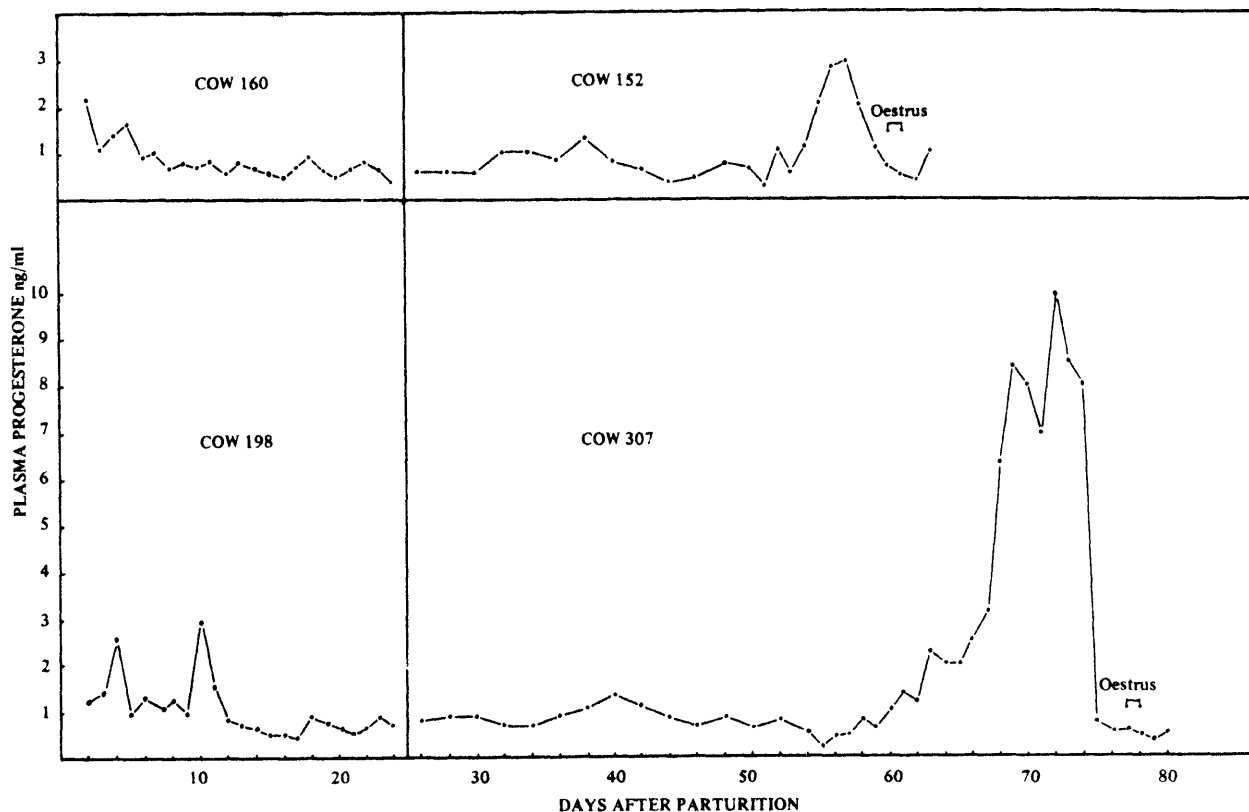


Table 1

The extent of plasma progesterone increase prior to first post partum oestrus in lactating Afrikaner cows

Cow Number	Parturition to first oestrus (days)	Progesterone levels				Duration of progesterone increase (days)
		Prior to pre-oestrus increase		At peak of pre-oestrus increase		
		ng/ml	Days before oestrus	ng/ml	Days before oestrus	
133	63	0,7	6	2,9	2	4
152	60	0,6	7	3,0	3	4
165	57	0,7	7	2,4	2	5
307	77	0,3	22	10,0	5	20
343	65	0,5	8	2,1	3	5

Prior to the first observed oestrus after parturition, an increase in plasma progesterone concentration was evident in all individuals. According to these elevated progesterone patterns, a silent ovulation was evident in only one of the animals (Fig. 1, cow 307). In this case plasma progesterone concentration increased from 0,3 ng/ml at 55 days *post partum* to a maximum of 10,0 ng/ml 17 days later. During the following 5 days progesterone concentration dropped precipitously to 0,6 ng/ml at which stage the animal exhibited oestrus. As this pattern of progesterone secretion is similar to that described by Coetzer *et al.* (1977) during a normal oestrous cycle in the Afrikaner, it is concluded that a silent ovulation occurred at approximately 55 days *post partum*. In suckled Angus cows Graves, Lauderdale, Hauser & Casida (1968) found that 70,6% of first ovulations were silent.

Progesterone increases observed in the 4 remaining cows showed little variation between individuals, but differed considerably, both in level and time, to that described for cow 307 (Table 1). In these 4 animals minimum progesterone levels increased from 0,5–0,7, 6–8 days before oestrus to maximum values of 2,1–3,0 ng/ml 2 to 3 days prior to oestrus. During the remaining time dropped consistently to reach levels of 0,3–0,7 ng/ml at oestrus (Table 1). This progesterone increase prior to the first *post partum* oestrus is similar to that described by Arije, Wiltbank & Hopwood (1974) for beef cows. Corresponding results were also reported by Donaldson, Bassett & Thorburn (1970), Erb, Surve, Callahan, Randel & Garverick (1972) and Henricks, Dickey, Hill & Johnston (1972). According to the

literature cited, there seems to be some difference of opinion as to the source of this progesterone increase. Castenson, Sorenson, Cobos & Fleegeer (1976) reported that in 7 of the 8 non-suckled, primiparous Hereford heifers studied, the initial *post partum* progesterone increase ($29,6 \pm 5,5$ days) was due to recent corpus luteum formation resulting from an ovulation and in the remaining heifer to a luteinized follicle. In dairy cattle Morrow *et al.* (1966) and Marion & Gier (1968) found that the growth and persistence of the corpus luteum following the first *post partum* ovulation may be subnormal and that the time from the first to second ovulation averages about 15 days. However, it seems improbable that the progesterone increase, as reported in this study, can be attributed to a corpus luteum resulting from an ovulation as these elevated progesterone levels lasted for only 4 to 5 days. The suggestion by Donaldson *et al.* (1970) that this increase in progesterone concentration may be associated with follicular development implying some luteinization of follicles, seems more likely. However, further detailed investigation is needed before any definite conclusions can be made.

According to the *post partum* plasma progesterone patterns established in the Afrikaner during this study, it appears that first ovulation does not occur as early after parturition as described by Morrow *et al.* (1966) and Saiduddin *et al.* (1968) in dairy cattle; that the incidence of silent ovulations is relatively low and does not occur early after parturition and that in most cases, first observed oestrus *post partum* can also be associated with first ovulation.

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