Der Tropenlandwirt, Zeitschrift für die Landwirtschaft in den Tropen und Subtropen
95. Jahrgang, April 1994, S. 77 – 86

Pre- and post-partum levels of serum progesterone and oestradiol-17β in Aardi goat

Prä- und postpartale Progesteron- und Estradiol-17β-Serumspiegel bei der Aardi Ziege

By M.S. Salah*

Progesterone and oestradiol-17β-concentrations were measured in the serum of 19 Aardi goats during the last month of pregnancy and the first 3 weeks postpartum. Serum progesterone concentrations (4.97-6.42 ng/ml) were mostly high before declining 1-2 days prepartum to reach very low levels (0.16-0.35 ng/ml) early postpartum. Serum oestradiol-17ß level increased progressively during late gestation to reach maximum values on the day of kidding (522-636 pg/ml) and declined rapidly within the next 2 days very low values (32-36) pg/ml). Litter size did not change significantly the pattern of progesterone levels, but affected significantly the values of oestradiol , with higher values for goats carrying twins.

1 Introduction

Changes occurring in the hormonal patterns during pregnancy, parturition, and early post-partum period have been studied in numerous species, including ruminants (BEDFORD et al. 1972, SMITH et al. 1973, CATCHPOLE 1977, THORBURN et al. 1972, WAGNER et al. 1974, BAZER and FIRST 1983). The corpus luteum, as a source for progesterone during gestation, is necessary for varying periods of time in different species. In goats, pregnancy depends on the presence of a functional corpus luteum throughout the whole gestation period (LINZELL and HEAP 1968). The production rate of progesterone by corpora lutea does not change tensiderably between the luteal

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phase of the oestrous cycle and over the duration of pregnancy in goats (HEAP et al. 1975). Parturition in the goat is preceded by a precipitous decline of progesterone 12 to 24 hours prior to initiation of labour (THORBURN et al. 1972, THORBURN and SCHNEIDER 1972, HEAP and LINZELL 1966, BLOM and LYNGSET 1970). Even a low level of exogenous progesterone at this time will cause prolonged gestation and dystocia (THORBURN et al. 1972).

Oestrogen concentrations in goat plasma during late gestation and at parturition have been studied by many workers (THORBURN et al. 1972, CURRIE et al. 1973, UMO et al. 1976, PATEL et al. 1992). It is increased progressively throughout pregnancy in goats (CHALLIS and LINZELL 1971). It is suggested that the fetoplacental unit is the source of oestrogens during gestation in goats (AINSWORTH and RYAN 1970). Although oestradiol-17β is produced in small quantities throughout in goat, it is required for the priming uterine contractility and giving favourable stimulus for oxytocin activity (BENGTSON and SCHOFIELD 1960, FOLLEY and KNAGGS 1965) and triggering prostaglandin release for more myometrial contractions (FAIRCLOUGH et al. 1975).

Studies, particularly physiologically reproductive studies, on the black heavy Aardi goats of the central region of Saudi Arabia (well adapted to arid environment) are very scarce. The main purpose of this study was to investigate the pattern of serum progesterone and oestradiol-17β around parturition in this breed. The importance of such a study in Aardi goats becomes also evident when we noted that the difference in circulatory oestradiol-17β levels reported prior to parturition in two Indian studies (JAIN et al. 1982, PATEL et al. 1992) was in the order of 1:6. This study also investigated the variation in these two hormonal trends as affected by litter size.

2 Material and methods

17 indigenous goats of the Aardi breed aged 1-4 years were used in this study. They were all served by the same buck during May and June, 1991. The day of mating was not known. All animals were kept under intensive management at the Animal Production Farm of King Saud University, Ryiadh. They received a balanced ration consisting of lucerne, hay, and concentrate (CP 14%), and were allowed free access to water and mineral salt licks. Blood sampling was taken twice a week beginning in September. All goats were kidded by mid-November. Some samples were taken successfully up to 15 minutes prior to, during, and 2 hours after kidding. Blood samples were taken daily for the first 5 days postpartum, and then every 5 days for the next 2 weeks. Blood samples were collected from the external jugular vein 10 ml vacutainer tubes with no additive. Samples were refrigerated overnight to allow for complete clotting and then centrifuged at 860x g for 20 min at 4° C. The serum then was decanted and stored at -20° C until it was assayed for progesterone and oestradiol-17β using the enzyme immunoassay (EIA) kits purchased from bio Merieux, Marcy-L'Etoile, France. Detai-

led instructions are provided with the kits. Cross-reactivities of the anti-progesterone antibody to progesterone, deoxycorticosterone, 16x-hydroxyprogesterone, testosterone, cortisol, and oestradiol were 100, 6.2, 1.6, < 0.09, < 0.02%, and < 0.02%, respectively. For anti-oestradiol-17β antibody cross-reactivities with oestradiol-17β oestrone, oestriol, corticosterone, progesterone, and testosterone were 100, 3.7, 0.5 < 0.003, < 0.003, and < 0.003. For the pooled plasma samples, the intra- and inter-assay coefficients of variation were 5.7 and 6.1% for progesterone and 6.4 and 8.3% for oestradiol 17β, respectively. The day of parturition has been taken as day 0, and pregnancy has been backed-dated from this time. Data from specific days of the last month of gestation and the first 3 weeks of lactation were subjected to statistical analysis (SAS User's Guide 1986) at King Saud University Computer Center to study the serum progesterone and oestradiol-17β patterns during late pregnancy and early lactation and the effect of litter size on these patterns in the Aardi goats. The least-square analysis of variance procedure was applied.

3 Results and discussion

The serum concentrations of progesterone throughout the last month of pregnancy up to the 3rd week of lactation in 17 Aardi goats, 7 of which were carrying single foetuses and the other 10 carrying twins, are shown in Fig. 1. The results are the mean values of 5-10 observations. In all animals, the progesterone concentration was at a reasonably steady level (4.97 ±0.13 - 5.77+0.16 ng/ml in animals with single foetuses and 5.02 ± 0.23 6.42+0.34 ng/ml with twins throughout the 28-day period preceding the last 2 days of pregnancy, when it declined (Fig. 2) towards the day of kidding (1,18+0.06 and 1.51+0.17 ng/ml, respectively). Statistically, these level did not differ significantly. The progesterone levels fell sharply after parturition (Fig. 2) and remained on very low levels through the first 3 weeks of lactation in both groups (0.16 - 0.35 ng/ml). However, the variation between individual animals in the mean concentration of serum progesterone was too high. The progesterone levels during the month preceding parturition in the serum of Aardi goats are comparable to those reported in other goats during late pregnancy (THORNBURN and SCHNEIDER 1972). Also, the decline in serum progesterone levels on the last day before parturition in the Aardi goats agrees with other results reported in other goat breeds (THORNBURN and SCHNEIDER 1972, HEAP and LINZELL 1966, BLOM and LYNGSET 1970, UMO et al. 1976). Similar changes has been reported in cows (POPE et al. 1969, SMITH et al. 1973, FAIRCLOUGH et al. 1975, HUNTER et al. 1977), ewes (BASSETT et al. 1969, STABENFELDT et al. 1972, CHAMLEY et al. 1973, THOMPSON and WAGNER 1974, HAMON and HEAP 1990) and dromedary camel (ELIAS et al. 1984a). After kidding, the levels of progesterone in the serum had fallen to very low levels in all goats. In Saanen goats, THORBURN and SCHNEIDER (1972) reported a fall plasma progesterone concentration to anoestrous two days after parturition. The present findings are also consi-

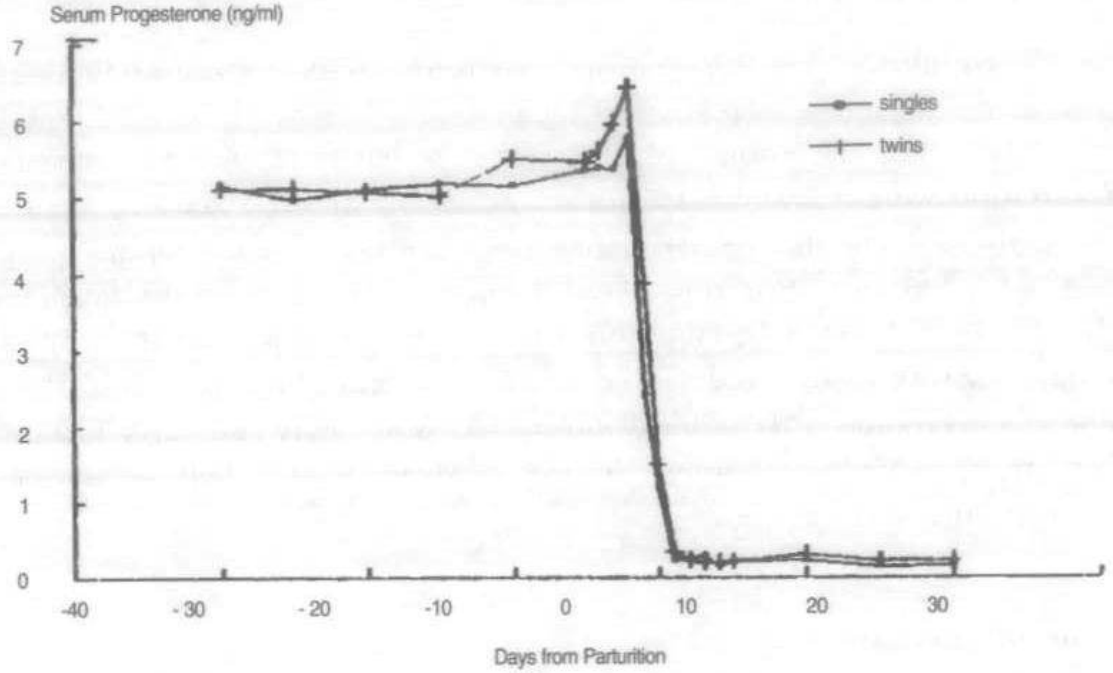

Fig. 1: Progesterone levels in serum during the last month of pregnancy and first 3 weeks of lactation in Aardi goats carrying single and twin foetuses.

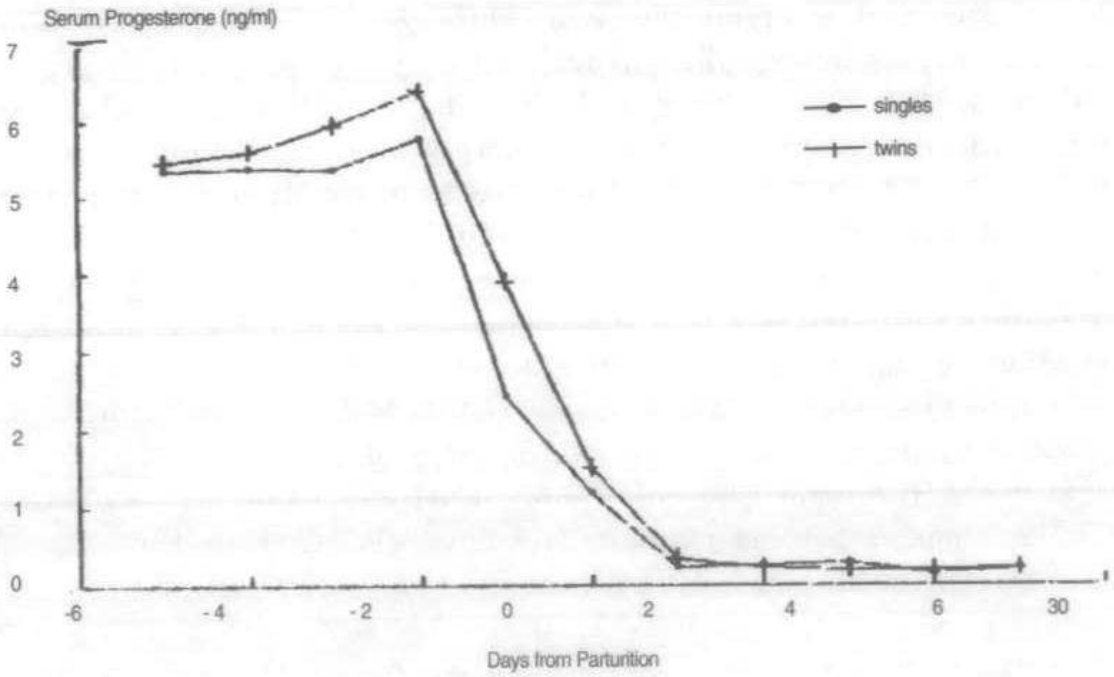

Fig. 2: Progesterone levels in serum 5 days pre- and post-partum in Aardi goats carrying single and twin foetuses.

stent with the observations of THORBURN and SCHNEIDER (1972), who showed that goats carrying twins tended to be somewhat higher in serum progesterone concentration than those carrying single foetuses, except that these differences were not significant in the present study. In superovulated goats (SINHA et al. 1979) and rabbits (POLIDORO and BLACK 1970) no direct relationship was found the between plasma progesterone concentration and litter size. Also in sheep, BASSETT et al. (1969) and STABENFELDT et al. (1972) showed a non-significant lower progesterone concentration in animals carrying a single foetus compared to those carrying twins. It seems that the progesterone levels in the peripheral circulation are of little importance in the diagnosis of multiple pregnancy in these species. Oestradiol-17β concentration in the serum of Aardi goats during the last month of pregnancy and up to the 3rd week of lactation were measured are shown in Fig. 3. The average serum oestradiol concentrations for 5-day intervals increased progressively from 139.6-232.0 pg/ml 30 days before parturition to 333.0-556.4 pg/ml one day before delivery to reach its highest level on the day of kidding (522.9-636.7 pg/ml). The highest oestradiol concentrations were found in the samples taken closest to the time before parturition. The increase in oestrogen levels with advancing pregnancy was reported in goats by other workers (THORBURN et al. 1972, DHINDSA et al. 1981, JAIN et al. 1982, AGARWAL et al. 1988, JAIN and MADAN 1989, PATEL et al. 1992). Also, oestrogen rises in the latter part of gestation in the cow (STABENFELDT et al. 1970, PETERSON et al. 1975, HOFFMANN et al. 1977), ewe (BEDFORD et al. 1972, THOMPSON 1973), camel (ELIAS et al. 1984b, AGARWAL et al. 1987), pig (WAGNER and OXENREIDER 1971, GUTHRIE et al. 1972, MOLOKWU and WAGNER 1973). After kidding, serum Oestradiol fell rapidly to very low levels (32-36 pg/ml within the first 2 days to 51-55 pg/ml during the 3rd week of lactation). The variation found in concentrations of serum oestradiol-17ß between goats was significantly high. All animals had elevated levels of oestradiol in their serum during the last 5 days of gestation (Fig. 4). Also, these levels were higher ($p < 0.05$) in goats bearing two foetuses than those bearing singles, which is supported by the work of DHINDSA et al. (1981). On the contrary, AGARWAL et al. (1988) did not find any significant difference in the serum oestrogens of goats bearing single or multiple foetuses. Estradiol-17β concentrations in the peripheral circulation of Aardi goats prior to parturition were little higher than those reported by PATEL et al. (1992) and much higher than those of JAIN et al. (1982) and JAIN and MADAN (1989) in other goats. After kidding, the serum oestrogens fell rapidly which is in agreement with the data of THORNBURN et al. (1972), UMO et al. (1976), and PATEL et al. (1992) in goats. These results confirm the supportive role of oestradiol-17β to the act of parturition in goats suggested by JAIN et al. (1982). Some increase in the levels of oestradiol-17β during the 3rd week of lactation, may be the result of postpartum ovarian follicle development and maturation at that time. In conclusion, myometrial activity associated with the onset of normal parturition may be realted to a significant decrease in circulating progesterone levels and oestradiol-17β may play a supportive role in this act.

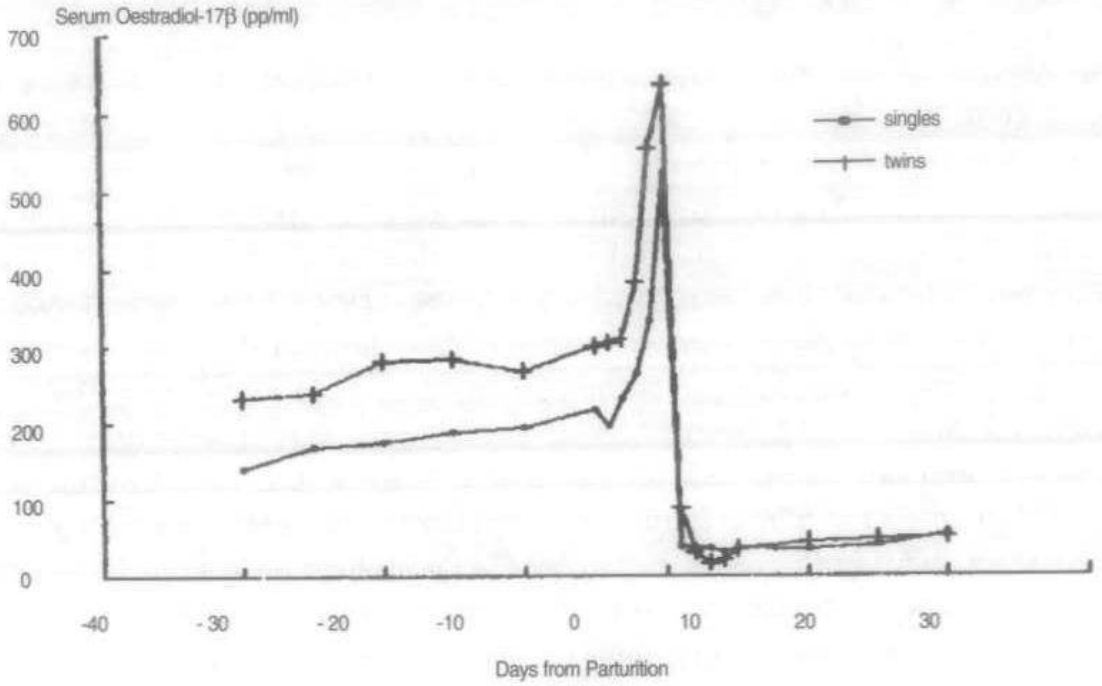

Fig. 3: Oestradiol-17ß concentrations in serum during the last month of pregnancy and first 3 weeks of lactation in Aardi goats carrying single and twin foetuses.

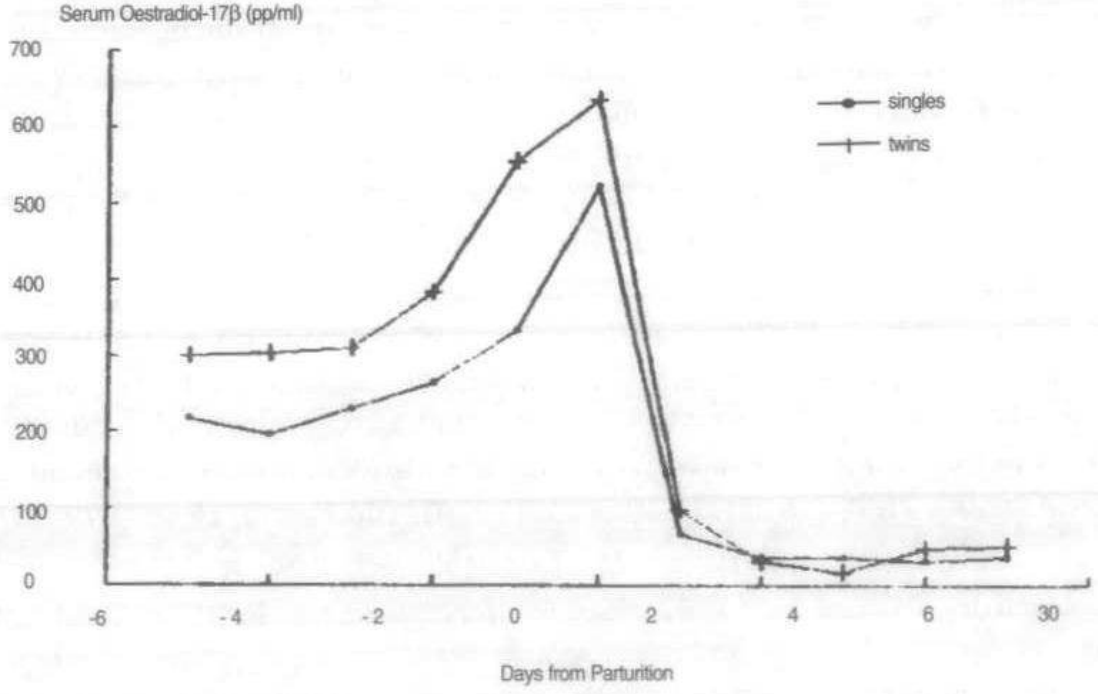

Fig. 4: Oestradiol-17ß concentration in serum 5 days pre- and post-partum in Aardi goats carrying single and twin foetuses.

Oestrogen but not progesterone levels at late gestation may help in determining the litter size in Aardi goats.

Zusammenfassung

Bei 19 Aardi Ziegen (Saudi-Arabien) wurden die Serum-Progesteron- und -Estradiol-17β-Konzentrationen im letzten Trächtigkeitsmonat und in den ersten 3 Puerperalwochen mit Hilfe des EIA bestimmt. Die Serumprogesteronkonzentrationen waren bis 1-2 Tage vor der Geburt zumeist gleichbleibend hoch (4.97-6.42 ng/ml) und sanken nach der Geburt auf sehr geringe Werte (0.16-0.35 ng/ml) ab. Die Serumestradiol-17β-Konzentrationen stiegen bis Ende der Trächtigkeit progressiv an, mit Maximalwerten (522-636 pg/ml) am Geburtstag, und sanken in den Folgetagen rasch auf Niedrigwerte (32-36 pg/ml) ab. Die Zahl der Leibesfrüchte hatte keinen signifikanten Einfluß auf den Progesteronspiegel im Gegensatz zum Estradiolspiegel, der bei Zwillingen signifikant höher war.

M.S. Salah: Concentrations sériques de progestérone et estradiol-17ß pré- et postnatales chez la chèvre Aardi

Chez 19 chèvres Aardi (d'Arabie Saoudite) ont été déterminées à l'aide de l'EIA les concentrations sériques de progestérone et estradiol-17β pendant le dernier mois de gestation et dans les trois premières semaines puerpérales. Les concentrations sériques de progestérone restaient jusqu'à 1 à 2 jours avant la naissance pour la part invariablement hautes (4.97-6.42 ng/ml), tombant après la naissance à des valeurs très basses (0.16-0.35 ng/ml). Les concentrations sériques d'estradiol-17β augmentaient progressivement jusqu'à la fin de la gestation, avec des valeurs maximales (522-636 pg/ml) le jour de la naissance, et elles tombaient le lendemain rapidement à des valeurs basses (32-36 pg/ml). Le nombre d'embryons n'avait aucune influence significative sur le taux de progestérone, contrairement au taux d'estradiol qui était plus élévé chez les jumeaux.

M.S. Salah: Nivel prenatal y postnatal de progesterona y estradiol-17ß en cabras Aardi

A 19 cabras Aardi (Arabia Saudita) les fueron determinados los niveles de concentración de progesterona y de estadiol-17β en muestras de suero, en el último mes de preñez y en las primeras 3 semanas luego de la parición, por medio del EIA. Las concentraciones de progesterona en el suero se mantuvieron hasta 1 a 2 dias antes del nacimiento a un nivel alto, pero constante (4,97-6,42 ng/ml) y disminuyeron después del nacimiento a valores muy bajos (0,16-0,35 ng/ml). Las concentraciones de estra-

diol-17β en el suero aumentaron progresivamente hasta fines de la preñez mostrando valores máximos (522-636 pg/ml) en el dia de la parición, para disminuir en los dias subsiguientes a bajos valores (32-36 pg/ml). La cantidad de cabritos por parición no tuvo una influencia significativa en cuanto al nivel de progesterona pero si en cuanto al nivel de estradiol, el cuál en caso de mellizos fué significativamente mayor.

Acknowledgments

This investigation was supported by a research grant from the College of Agriculture Research Center, King Saud University. The author thanks all members of the Animal Farm of the same college headed by Mr. Ali KHALIL for their help and support. Also, the help and assistance of Dr. H.H. MOGAWER during the field and laboratory work is greatly appreciated.

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