

PHYSICOCHEMICAL PROPERTIES OF THE CERVICAL MUCUS OF THE PREGNANT CAMEL (*Camelus dromedarius*)

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ABSTRACT

This study was conducted to determine the base-line data of the physicochemical properties of the cervical mucus during pregnancy in five camels. An increase in concentrations of plasma progesterone, protein, and activity of acid and alkaline phosphatase was observed in the cervical mucus of the pregnant compared to the non-pregnant camels. Decreasing values of the flow of elasticity, but not that of pH or specific gravity were also found. It is suggested that pregnancy establishment in the camel can be predicted based on the physicochemical properties of the cervical mucus.

INTRODUCTION

The physicochemical composition of the cervical mucus of most animal species shows cyclical changes which may be under hormonal control (Linford, 1974). The cervical mucus is essential to sperm motility and reservation (Adams, 1976).

No information is available on the properties of the cervical mucus in the pregnant camel, hence this study was undertaken to collect baseline data on the physicochemical properties of the cervical mucus of the pregnant camel.

MATERIALS AND METHODS

Collection of cervical mucus

Samples of the cervical mucus (0.2 ml) were collected from 5 non-pregnant camels (*Camelus dromedarius*) when ovarian follicles were palpable. These animals were mated at oestrus and the mucus was collected thereafter at a fortnight interval until the day of parturition. The mucus was collected via gentle suction into a polyethylene catheter (50 cm long with 0.5 cm i.d and 0.8 cm o.d.). All samples were stored at -20°C until analysed.

Collection of blood samples

Jugular blood sampling was carried out by direct venipuncture at the time of mucus collection. All blood samples (5 ml) were collected into heparinized syringes, centrifuged at 1000 g for 10 min and plasma was stored at -20° C until analysis.

Laboratory methods

Plasma progesterone was measured by

radioimmunoassay method previously described (Homeida and Al-Eknah, 1992). One ml of plasma was extracted with hexane. Progesterone antibody at a dilution of 1:7000 was added. The sensitivity of the assay was 48 pg/ml, and the intra and inter-assay coefficients of variation were 6% (n = 11) and 11% (n = 15), respectively. Extracts on efficiency were 76 to 81% and the results were corrected for procedural losses.

Protein in the mucus was measured in thawed samples by the biuret method. The principle of the method is based on the reaction of the protein with copper sulphate in the presence of sodium hydroxide. Changes in the spectra were read at 540 μ (Evans Electro-selenium, Ltd., England). Values were calculated from standard curve prepared from bovine serum albumin. The activities of alkaline and acid phosphatases in the mucus were determined colorimetrically (Varley *et al.*, 1980), using P-nitrophenyl (a substrate) as previously validated (Al-Eknah *et al.*, 1991). The optical density was read at 520 nm on a colorimeter (Perkin-Elmer, England). Unit activity of the enzyme was calculated as μ m-nitrophenol liberated per hour per gm of cervical mucus at 37°C.

The pH of the mucus was determined colorimetrically as suggested by Zaaijer *et al.*, 1993), and specific gravity by the method of copper sulphate (Sokolovskaya and Skopets, 1986). Flow elasticity of the mucus was examined by the technique of Mehmood *et al.*, 1991. Data were analysed using the student's t test and correlation coefficient.

RESULTS

The mucus collected during the follicular phase of the oestrous cycle was watery, whereas that collected

Table 1: Mean (\pm SD) plasma progesterone concentration and physico-chemical composition of the cervical mucus in the pregnant and non-pregnant camels (n=5)

	Non pregnant	Early pregnant (1-2 months)	Mid pregnant (3-8 months)	Late pregnant (9-12 months)	Last week of pregnancy
Progesterone (ng/ml)	0.12 \pm 0.03a	3.3 \pm 0.26b	3.5 \pm 0.25b	3.1 \pm 0.12b	3.18 \pm 0.27b
pH	7.17 \pm 1.60a	8.23 \pm 0.11a	8.35 \pm 0.20a	8.26 \pm 0.15a	8.30 \pm 0.15a
Specific gravity	1.002 \pm 0.001a	1.009 \pm 0.001a	1.002 \pm 0.001a	1.001 \pm 0.001a	1.012 \pm 0.001a
Flow elasticity (mm)	11.1 \pm 1.1a	3.46 \pm 0.55b	2.82 \pm 0.49b	2.26 \pm 0.15b	2.20 \pm 0.16b
Protein (mg/g)	0.80 \pm 0.10a	2.26 \pm 0.15b	3.67 \pm 0.46b	4.17 \pm 0.15b	4.06 \pm 0.20b
Acid phosphatase (units/g)	2.3 \pm 0.10a	9.16 \pm 0.15b	10.23 \pm 0.09b	10.6 \pm 0.45b	10.28 \pm 0.24b
Alkaline phosphatase (units/g)	1.60 \pm 0.11a	11.63 \pm 0.38b	11.27 \pm 0.29b	11.43 \pm 0.20b	10.04 \pm 0.68b

values with different superscripts in a row differ significantly ($P < 0.001$).

during pregnancy was viscid in nature. Results of plasma progesterone, protein, acid and alkaline phosphatases, pH, specific gravity, and flow elasticity of the mucus are shown in Table 1. A corresponding increase in the levels of plasma progesterone (from 0.1 to 3.0 ng/ml), acid ($r = 0.91$; from 2 to 10 units/g) and alkaline phosphatases ($r = 0.90$; from 1 to 11 units/g) in the mucus was observed. Highly significant ($P < 0.001$) difference in level of plasma progesterone and protein, acid and alkaline phosphatases and flow elasticity in the mucus of the pregnant compared to the non-pregnant animals was demonstrated.

There was a tendency of pH and specific gravity values to increase, though not significant during pregnancy. Once pregnancy was established, there was no change in values of all parameters estimated throughout the gestation period (Table 1).

DISCUSSION

During pregnancy, the cervical mucus secretion forms a plug which functionally seals off the vaginal canal from the uterine cavity (Guyton, 1991). Properties of such secretion should be unique enough to qualify mucus for such role. The results presented in this study indicate that pregnancy in the camel is accompanied with changes in physicochemical properties of the cervical mucus. Parallel increase in plasma

progesterone and protein, and alkaline and acid phosphatases in the mucus was demonstrated in this study.

Hormonal treatments have been shown to change the composition of cervical mucus in the goat (Al-Eknaah *et al.*, 1991), ewe (Woodward *et al.*, 1971) and cow (Boyd *et al.*, 1972). Such biochemical changes in the mucus may be related to the changes in the composition of uterine secretion during pregnancy (Noonan *et al.*, 1975). Similar effects were produced after injection of progesterone in sheep and cattle (Smith and Allison, 1971; Boyd, *et al.*, 1972), and also during the luteal phase of the cow and goat (Eltohamy and Zakaria, 1990; Al-Eknaah *et al.*, 1991). A decrease in the degree of hydration under the influence of progesterone which leads to mucus concentration or alteration in glycoprotein and other cellular proteins may form linkages and arrangements which affect the flow elasticity of the mucus (Prasad *et al.*, 1981; Hafez, 1987).

The results of this study indicate the possibility of predicting establishment of pregnancy status in the camel based on physical and biochemical properties of the cervical mucus. However, carelessness in collecting cervical mucus may disturb the cervical seal and cause abortion. Further investigations are required to define clearly the association between hormonal and physicochemical properties of the cervical mucus during oestrous cycle and early pregnancy of the camel.

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