

COMPARISON OF THE DISTRIBUTION OF MOTILE AND IMMOTILE SPERMATOZOA IN THE OVINE CERVIX*

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In ruminants, large numbers of spermatozoa are found in the cervix in recently mated animals (Quinlan, Maré, and Roux 1932; Starke 1949; Mattner 1963, 1968). The spermatozoa are not randomly distributed throughout the lumen of the cervix but tend to aggregate in the vicinity of the cervical mucosa, particularly in the crypts between the cervical villi (Mattner 1966). It has been postulated (Mattner 1966) that the majority of the spermatozoa that enter the cervix progress toward the cervical mucosa as a result of their own motility and of the directional restraint imposed on their movement by the anisotropy of the mucus. If this hypothesis is correct, immotile spermatozoa introduced into the cervix should not aggregate in the vicinity of the cervical mucosa. Nor should they pass toward the uterus counter to the flow of the cervical mucus except during the phase of rapid transport of spermatozoa that may occur for a short time after mating in undisturbed animals (Vandemark and Hays 1954; Mattner 1963). The distribution of spermatozoa in the cervix of ewes inseminated with killed spermatozoa was examined to test the hypothesis.

Experimental

Sixteen parous Merino ewes were each inseminated during early oestrus with a dose of 0.2 ml of ram semen (600–800 million spermatozoa) deposited in the first fold of the cervix. Eight of the ewes were inseminated with freshly collected semen in which more than 80% of the spermatozoa were motile. The remainder were inseminated with semen in which the spermatozoa had been killed by cold shock. Four ewes in each group were killed 0.5 hr later and the remainder were killed 4 hr after insemination. Immediately after slaughter the cervix was removed, divided transversely into quarters which were numbered sequentially from the caudal end of the cervix, and fixed in 10% formol saline. The number of spermatozoa in each quarter was estimated from counts of spermatozoa in four stained transverse sections taken at equidistant points along each quarter (Mattner 1966).

Results

At both 0.5 and 4 hr, greater numbers of spermatozoa were found in the cervixes of the ewes inseminated with fresh semen than in the cervixes of those inseminated with killed spermatozoa. In the former ewes there was an increase in the number of spermatozoa in quarters 3 and 4 of the cervix between 0.5 and 4 hr after insemination (Table 1). In the latter ewes spermatozoa were found only in quarters 1 and 2 at 0.5 hr and only in quarter 1 at 4 hr after insemination.

There was also a marked difference between the groups in the distribution of spermatozoa within individual sections of the cervix. In the ewes inseminated with

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fresh semen, $54 \pm 5\%$ (S.E.) and $78 \pm 4\%$ of the spermatozoa were between the cervical villi or within the cervical glands at 0.5 and 4 hr respectively. However, spermatozoa were found only in the central area of the cervical lumen in the ewes inseminated with killed spermatozoa.

TABLE 1
NUMBERS OF SPERMATOZOA IN REGIONS OF THE CERVIX IN EWES INSEMINATED
WITH LIVE OR DEAD SPERMATOZOA

Numbers in parentheses are the number of ewes in which spermatozoa were found.
Group size = 4

Time from Insemination to Slaughter (hr)	$10^{-6} \times$ Mean No. of Spermatozoa in Cervical Quarters*			
	1	2	3	4
Inseminated with live spermatozoa				
0.5	7.98 (4)	7.00 (4)	2.15 (4)	0.12 (3)
4	3.96 (4)	4.09 (4)	2.83 (4)	1.90 (4)
Inseminated with dead spermatozoa				
0.5	0.90 (4)	0.002 (4)	0	0
4	0.003 (4)	0	0	0

* Antilog of mean \log_{10} number of spermatozoa; quarters numbered sequentially from the caudal end of the cervix.

The finding that the killed spermatozoa were present only in the central area of the lumen of the cervix is consistent with the hypothesis that the passage of spermatozoa through the cervical mucus to the cervical mucosa is effected by their own motility. Since few of the previously killed spermatozoa were recovered from the cervixes it also appears that unless spermatozoa are motile they are rapidly eliminated from the cervix—possibly by being carried with the mucus as it passes from the cervix into the vagina. This may account, in part, for the finding that the ratio of motile to immotile spermatozoa is higher in the cervix than in other parts of the female genital tract in sheep (Quinlan, Maré, and Roux 1932; Starke 1949; Mattner 1963), in goats (Mattner 1968), and in cattle (Beshlebnov 1938; Sergin *et al.* 1940).

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