1968

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J. Reprod. Fert. (1968) **16,** 179–182

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II. SEMINAL CHARACTERISTICS AND BREEDING TRIALS

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(*Received* 12*th June* 1967)

Summary. Semen was evaluated before and after seminal vesiculectomy in seven bulls. Volume, motility, percentage of live cells and primary abnormalities decreased, while cell concentration and secondary morphological abnormalities increased. Five of the bulls were mated with heifers and had acceptable fertility. The vesicular glands influence certain seminal characteristics but are not essential to fertility.

INTRODUCTION

Seminal vesicles are the main source of fructose, the principal metabolic substrate available to spermatozoa in the semen of most species. While fructolysis is important to the activity of bovine sperm cells *in vitro*, the relationship of vesicular gland secretions to the fertility of bull semen is not clear. Epididymal and even testicular spermatozoa are capable of fertilizing ova in some species, but their fertilizing ability is less than that of ejaculated spermatozoa (Nalbandov, 1964). The present report describes changes in gross and microscopic properties of the semen of seven vesiculectomized bulls and the results of breeding trials with five of the animals.

MATERIALS AND METHODS

Semen was evaluated using minor modifications of the method of Carroll, Ball & Scott (1963). Ejaculates were collected in a graduated tube, and cell concentration was scored 1 to 5 in order of increasing concentration. Motility, evaluated at 100 magnifications, was likewise scored 1 to 5, with 5 representing the best motility. Percentage of live cells was determined by counting 100 cells stained with eosin and nigrosin. Morphology was evaluated on 100 cells, using the classification of Blom (1950). Differences between mean values were compared by Student's *t*-test (Steel & Torrie, 1960).

After characterization of the semen, the bulls were vesiculectomized. Two bulls (2171, 2240), not reported in the previous paper (Shah, Hopwood & Faulkner, 1968), were studied first. Nine months after vesiculectomy each was allowed to serve eight Hereford heifers. The bulls were penned apart from the

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Table 1

SEMINAL CHARACTERISTICS BEFORE AND AFTER SEMINAL VESICULECTOMY

Bull No.		*No. samples*	*Concentration score*	*Volume (ml)*	*Motility score*	*Live cells (%)*	*Abnormal cells (%)*		*Fructose (mg/100 ml)*	*Citric acid (mg/100 ml)*
							Primary	*Secondary*		
2172	Before	8	3·2	2·7	3·9	72	7·1	10·2	430	708
	After	21	4·1†	1·7†	3·8	54†	5·2	7·6	26†	72†
2240	Before	8	2·9	3·2	3·1	45	9·8	33·1	547	692
	After	20	3·9†	1·3†	1·2†	4†	4·6†	68·6†	22†	53†
3018	Before	15	4·1	6·2	3·5	40	7·1	18·4	412	981
	After	14	4·5†	3·5†	2·8†	48	6·8	42·9*	26†	214†
3021	Before	10	4·0	5·2	3·8	63	9·7	23·1	347	935
	After	20	4·5	4·6	3·5	57	6·5*	18·7	156†	627*
3024	Before	10	4·0	4·9	4·2	62	7·7	9·4	320	1036
	After	14	4·9†	3·0†	3·8	45	5·0	21·4†	55†	392†
3053	Before	15	3·9	6·3	3·8	49	8·1	25·6	470	898
	After	8	3·8	2·5†	1·4†	12	2·8†	66·2†	23†	221†
Average	Before	66	3·8	5·1	3·7	54	8·1	20·2	421	875
	After	97	4·3‡	2·7‡	2·9‡	40‡	5·4‡	33·6‡	51‡	263‡

* Significant from 'before' value ($P<0·05$).
† Significant from 'before' value ($P<0·01$).
‡ Significant from 'before' value ($P<0·005$).

heifers, which were taken to the bull when oestrus was first observed. The first service was observed, and then the heifer was allowed to remain with the bull.

A year later, three of five bulls described in the preceding report were used in a natural mating trial. Bulls 3021 and 3053 were each placed with twenty Hereford heifers. Bull 3053 lacked libido and had difficulty in intromission and ejaculation. He was removed after 4 days and replaced by bull 3018. Bull 3021 remained with the heifers for 60 days and bull 3018 for 56 days. Each bull was with the assigned heifers from early morning to dusk and was penned away from the heifers during the night. Mating activity was checked four to six times daily. Breeding started 2 months after removal of the seminal vesicles from bulls 3018 and 3053 and 9 months after surgery for bull 3021. Heifers were examined for pregnancy 36 to 67 days after the last service.

RESULTS

Seminal characteristics

Mean values of seminal characteristics before and after seminal vesiculectomy are shown in Table 1. Volume, motility, live cells and primary abnormalities decreased, while cell concentration and secondary morphological abnormalities increased, although there were marked variations between bulls. The subjective appraisal of sperm-cell concentration and motility may have contributed to the failure to achieve significance in some cases. Surgical removal of vesicular glands was incomplete in bull 3021, and palpable stumps remained.

TABLE 2

BREEDING TRIALS WITH SEMINAL VESICULECTOMIZED BULLS

Bull No.	*No. heifers on trial*	*No. heifers served*	*No. heifers pregnant*	*Conception (%)*	*First service conceptions*	*Services/ conception*
2172	8	7	5	71	5	1·4
2240	8	8	6	75	6	1·3
3018	20*	16	12	75	11	1·8
3021	20	18	18	100	16	1·1
3053†	20	5	2	40	2	2·5

* Two heifers were pregnant to bull 3053.
† Bull removed from trial after 4 days, replaced with bull 3018.

Breeding trials

Results of the breeding trials are shown in Table 2. Five of seven heifers were impregnated by bull 2172, and six of eight heifers by bull 2240. Bull 3053 served five heifers in 4 days, and two became pregnant. The fertility of this bull may have been underrated, since two of the three heifers he failed to impregnate also failed to conceive to the service of bull 3018. The third heifer became anoestrus following service to bull 3053. Bull 3018 served sixteen of the heifers which were originally with bull 3053, and twelve conceived. Bull 3021 produced pregnancy in eighteen heifers at twenty oestrous periods. The remaining two heifers were not detected in oestrus and had inactive ovaries on examination.

DISCUSSION

We expected that cell concentration would increase and that volume and motility would decrease following seminal vesiculectomy, but changes in percentage live cells and morphological characteristics were unexpected. Known contributions of the gland, i.e. fructose, citric acid, nitrogen, alkaline phosphatase and a fluid relatively poor in chloride, could conceivably alter permeability and intermediary metabolism to explain changes in staining characteristics and motility. The evidence indicates that the absence of the seminal vesicles causes significant changes in sperm cell morphology.

Bull 3021, incompletely vesiculectomized, had the highest fertility and semen quality and the least change in seminal biochemistry. These findings may suggest a role for vesicular gland fluid in supporting semen quality and fertility. On the other hand, the findings may merely reflect the characteristic of an individual bull. At any rate, the breeding efficiency of three of the four completely vesiculectomized bulls was certainly acceptable, despite the changes in their semen. Moreover, the fertility of bull 3053 may have been better than the number of conceptions indicated. Seminal vesicles have been removed from boars and rats without impairment of fertility (Nalbandov, 1964), and we conclude that the vesicular glands are not essential to fertility in the bull. Since the vesicular glands contribute the major metabolic substrate available to spermatozoa in semen, and seminal vesiculectomy does not prevent fertility, metabolic needs of the male gamete must be provided by secretions of the female genital tract.

ACKNOWLEDGMENTS

This work was supported by United States Public Health Service Grant GM 07120 from the National Institute of General Medical Sciences and by Colorado State Experiment Station Project 57. Published as Colorado State University Scientific Series No. 1179.

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