

RELATIONSHIPS BETWEEN SIDE OF PREGNANCY AND SIDE OF SUBSEQUENT OVARIAN ACTIVITIES IN BEEF AND DAIRY CATTLE*

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Summary. Records from both beef and dairy cows were used to test for utero-ovarian relationships during post-partum anoestrus. It was found that ovarian activity (follicular development and ovulation) first occurred in the ovary opposite the side of the recent pregnancy in a significant majority of the observations. This tendency was greater in the dairy cows. The proportion of cows with ovarian activity on the 'opposite side' tended to decrease as the length of the interval from calving to ovarian activity increased. However, the average length of the interval from calving to follicular development or ovulation did not differ significantly between 'same side' and 'opposite side' animals.

Cows served at the first ovulation after calving had better conception rates when the ovulation occurred on the side opposite the previous pregnancy. This difference between the two sides was greater for cows whose uteri had not yet involuted at the time of service.

INTRODUCTION

Various reports in the literature have indicated that relationships may exist between uterine and ovarian activities in post-partum cows. Buch, Tyler & Casida (1955) reported a significant correlation between the intervals from calving to oestrus and to uterine involution in dairy cows. Wiltbank & Cook (1958) found that Shorthorn cows nursing calves had longer intervals from calving to both uterine involution and first ovulation than did cows milked twice daily. In another study, injecting beef cows with progesterone and oestradiol-17 β after calving shortened the time to uterine involution and to first ovulation (Foote & Hunter, 1964).

Direct utero-ovarian relationships have been reported in various species (see review by Ginther, 1967). In non-pregnant cattle, these relationships have been demonstrated by inserting devices into one uterine horn (Ginther, Woody, Janakiraman & Casida, 1966), by unilateral hysterectomy and by oxytocin treatment in conjunction with unilateral hysterectomy (Armstrong & Hansel, 1959; Anderson, Bowerman & Melampy, 1965). Since, in some cases at least,

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the effects were unilateral, it was of interest to test for this type of activity in cows during the post-partum interval when a marked difference exists between the size of the two uterine horns, and when the ovaries are resuming follicular development and ovulation.

Uterine and ovarian changes during the interval following calving have been described by various workers (Casida & Venzke, 1936; Buch *et al.*, 1955; Ulberg & Lindley, 1960; Foote & Hunter, 1964; and others).

In this study we have examined uterine and ovarian activities to determine whether or not a direct relationship exists between the uterus and the ovaries in beef and dairy cows during the period following calving.

MATERIALS AND METHODS

Records from 129 Hereford cows and fifty-two Holstein cows were analysed. Observations were made during the interval between parturition and the subsequent service; they included which uterine horn had contained the foetus, the time taken for uterine involution, and the side of ovarian follicular development and ovulation. Comparisons were made by chi-square (Dixon & Massey, 1957) to determine whether ovarian activity first occurred on the opposite side or the same side as the recently pregnant uterine horn. Tests were also made by chi-square to see whether the involutionary state of the uterus, the length of interval after calving, and the type of animal (beef or dairy) influenced this utero-ovarian relationship. For brevity the terms 'same side' and 'opposite side' are used hereafter to describe the ipsilateral and contralateral relationships between the recently gravid uterine horn and the ovary first showing activity *post partum*.

The intervals from calving to the first appearance of a 12-mm follicle and to the first ovulation were compared between the various groups of animals by analysis of variance.

All observations were made by rectal palpation of the reproductive tract. The uterine horn that had contained the foetus was determined by pregnancy diagnosis during gestation and by uterine condition soon after calving. Uterine involution was considered to be complete when the organ had returned to its normal site, size and tone. Ovulation was determined by detection of a developing corpus luteum. The time of ovulations not accompanied by oestrus was estimated by subtracting 7 days from the first weekly palpation at which a corpus luteum was detected.

RESULTS

General relationships

First 12-mm follicle. The number of animals with the various combinations of the uterine horn recently pregnant and the ovary developing the first 12-mm follicle *post partum*, and the average intervals from calving to this follicular development are shown in Table 1. This interval did not differ significantly between same and opposite sides in either the beef or dairy breeds, but it was 5 days longer in beef cows in both the same side and opposite side groups.

The number of cows developing their first 12-mm follicle on the opposite

side was significantly greater than the number developing it on the same side for both beef cows (60%; $P < 0.025$) and dairy cows (73%; $P < 0.01$).

First ovulation. The same trend was found between the uterine horn recently pregnant and the side of the first ovulation (Table 2). Average calving to ovulation intervals did not differ significantly between groups within breeds. However, this interval was significantly longer ($P < 0.05$) in the beef cows for both same and opposite side ovulations.

Fifty-four per cent of the beef cows and 64% of the dairy cows ovulated first on the opposite side. Both of these differences were significant ($P < 0.05$).

TABLE 1

RELATIONSHIP BETWEEN SIDE OF UTERINE HORN RECENTLY PREGNANT AND SIDE OF OVARY DEVELOPING FIRST 12-MM FOLLICLE POST PARTUM

Type animals	Same side*			Opposite side*			Total		
	R. horn— R. ovary			R. horn— L. ovary			Same side*		
	No.	%	Av.†	No.	%	Av.†	No.	%	Av.†
Beef	37	73	29	14	27	25	51	40	27
Dairy	12	86	24	2	14	16	14	27	22

* Side of first 12-mm follicle relative to side of recent pregnancy.

† Average intervals in days from calving to first detected 12-mm follicle.

TABLE 2

RELATIONSHIP BETWEEN SIDE OF UTERINE HORN RECENTLY PREGNANT AND SIDE OF FIRST OVULATION POST PARTUM

Type animals	Same side*			Opposite side*			Total		
	R. horn— R. ovary			R. horn— L. ovary			Same side*		
	No.	%	Av.†	No.	%	Av.†	No.	%	Av.†
Beef	38	63	46	22	37	48	60	46	47
Dairy	16	84	32	3	16	36	19	36	33

* Side of ovulation relative to side of recent pregnancy.

† Average intervals in days from calving to first ovulation.

Effect of uterine condition on side of ovulation

The data were also analysed to see whether the uteri were or were not involuted at the time of the first ovulation (Table 3). The percentages of beef cows ovulating on the opposite side were 47 and 57 for the not involuted and involuted groups. Comparable figures for the dairy cows were 67% and 43%. In the not involuted dairy group significantly more animals ovulated on the opposite side ($P < 0.05$). It appears, therefore, that in dairy cows the tendency to ovulate on the opposite side is greater when ovulation occurs before uterine involution.

Effect of interval after calving

First 12-mm follicle. Table 4 shows the numbers and percentages of animals which first developed 12-mm follicles and which first ovulated on the same and

opposite sides at different time intervals after calving. In the beef cows, 69% of the 12-mm follicles detected within 20 days after calving were on the opposite side, but only 57% of those developed after 20 days were on the opposite side. The differences between the same and opposite sides were significant ($P < 0.025$) for the interval of 20 days or less, but non-significant for the interval after this time.

TABLE 3
RELATIONSHIP BETWEEN SIDE OF FIRST OVULATION POST PARTUM AND
CONDITION OF UTERUS AT TIME OF FIRST OVULATION

Side*	Beef						Dairy					
	Not involuted			Involuted			Not involuted			Involuted		
	No.	%	Av.†	No.	%	Av.†	No.	%	Av.†	No.	%	Av.†
Same	24	53	36	36	43	55	15	33	28	4	57	48
Opposite	21	47	37	48	57	56	30	67	25	3	43	46

* Side of ovulation relative to side of recent pregnancy.

† Average intervals in days from calving to first ovulation.

TABLE 4
INFLUENCE OF INTERVAL LENGTH POST PARTUM ON UTERO-OVARIAN
RELATIONSHIPS

Side*	Beef				Dairy			
	< 21 days to first 12-mm follicle		> 20 days to first 12-mm follicle		< 21 days to first 12-mm follicle		> 20 days to first 12-mm follicle	
	No.	%	No.	%	No.	%	No.	%
Same	11	31	40	43	8	28	6	27
Opposite	25	69	53	57	21	72	16	73

Side*	Beef				Dairy			
	< 31 days to first ovulation		> 30 days to first ovulation		< 31 days to first ovulation		> 30 days to first ovulation	
	No.	%	No.	%	No.	%	No.	%
Same	8	50	52	46	8	26	11	52
Opposite	8	50	61	54	23	74	10	48

* Side of first 12-mm follicle or ovulation relative to side of recent pregnancy.

The percentages of 12-mm follicles developed on the opposite side by dairy cows were 72 and 73 for the less than 21- and more than 20-day intervals. Both of these percentages differed significantly ($P < 0.025$) from a 50:50 ratio.

First ovulation. Intervals in which ovulations were studied were 30 days or less and greater than 30 days after calving. No significant differences were found between the number of animals ovulating on the same versus the opposite side for either time interval in beef animals. In dairy cows, 74% of the ovulations

occurring within 30 days were on the opposite side, whereas 48% occurred on the opposite side after 30 days. The differences between the same and opposite sides were significant ($P<0.01$) for the earlier but not the later interval.

Other observations

Fifty-two of the beef cows were served by natural mating at the first post-partum oestrus. The proportions of these cows, categorized by utero-ovarian combinations and uterine involutionary states, which conceived at this service, are shown in Table 5. In the group whose uteri had not yet involuted, there was

TABLE 5
RELATIONSHIP OF UTERINE HORN RECENTLY PREGNANT AND SIDE OF
OVULATION TO CONCEPTION RATE AT FIRST SERVICE POST PARTUM IN
BEEF COWS

	<i>Conception at first service</i>					
	<i>Not involuted*</i>		<i>Involuted†</i>		<i>Total</i>	
	<i>Proportion</i>	<i>%</i>	<i>Proportion</i>	<i>%</i>	<i>Proportion</i>	<i>%</i>
Same side‡						
R. horn-R. ovary	6/11	54	4/6	67	10/17	59
L. horn-L. ovary	2/5	40	4/5	80	6/10	60
Total	8/16	50	8/11	73	16/27	59
Opposite side‡						
R. horn-L. ovary	4/6	67	5/5	100	9/11	82
L. horn-R. ovary	6/8	75	2/6	33	8/14	57
Total	10/14	71	7/11	64	17/25	68

* Uterus not involuted at time of first ovulation.

† Uterus involuted at time of first ovulation.

‡ Side of ovulation relative to side of recent pregnancy.

TABLE 6
RIGHT VERSUS LEFT SIDE ACTIVITIES

<i>Phenomena</i>	<i>Percentages occurring on right side</i>	
	<i>Beef</i>	<i>Dairy</i>
Recent pregnancy	54	59
First 12-mm follicle	55	61
First ovulation	59	65
Conception at first service	55	—

a 50% conception rate in animals which ovulated on the same side and a 71% conception rate in those ovulating on the opposite side. The conception rates for cows whose uteri had involuted by the time of service were 73% and 64% for the same and opposite side groups, respectively.

Several comparisons were also made between the right and left uterine horns, and between the right and left ovaries as shown in Table 6. More than 50% of all activities were on the right side.

Fifty-eight per cent of the beef cows which first ovulated from the right ovary and were mated at this ovulation conceived. This figure for the left ovary was 72%.

As expected, cows usually ovulated from the same ovary in which follicular development first appeared. Sixty-one percent of both the beef and dairy cows developed their first 12-mm follicles and ovulated from the same ovary. The dependency of the side of first ovulation on the side of first 12-mm follicle development was significant ($P < 0.01$) for each breed. The number of first 12-mm follicles that actually ovulated is not known.

DISCUSSION

The results of this investigation indicate that ovarian activity after calving occurs more often on the side opposite that of the recent pregnancy. This difference between sides decreases as the time interval after calving increases. An observed difference between beef cows and dairy cows for this phenomenon may result from the difference in the time of resumption of ovarian function after calving. The beef cows, which resumed ovarian activity later than the dairy animals, showed a significant difference between same and opposite sides in early follicular development. However, this effect was not observed in follicles developing later and by the time ovulation occurred. The dairy cows began ovarian activity earlier, and this differential effect persisted until after ovulations began but decreased to non-significance by the time the later ovulations occurred. Differences in genotype or environment, or both, may cause dairy cows to develop follicles and ovulate earlier after calving when a great difference still exists between the uterine horns, and possibly also between other asymmetrical conditions peculiar to pregnancy or the post-partum interval. In this investigation, the beef cows were all nursing calves without restriction and were on pasture. The dairy cows were machine-milked twice daily and received hay and grain.

The average time intervals from calving to the appearance of the first 12-mm follicle and to ovulation did not differ significantly between the same and opposite sides for either the beef or dairy cows. This suggests that the unilateral influence observed does not delay ovarian function on the same side, but decreases the chances of initiation of activity by this ovary. Casida & Venzke (1936) found earlier follicular development on the opposite side in dairy cattle.

The present results suggest a direct unilateral influence on ovarian function. However, the nature or source of this influence is speculative. It is assumed that the recently gravid uterine horn inhibits (or fails to stimulate) the adjacent ovary and that its influence diminishes as equality between the uterine horns is approached. It is also possible that the regressing corpus luteum of pregnancy may have a direct effect (immediate or carry over) on the ovary. However, there appears to be no evidence that ovarian function during the oestrous cycle affects the side of subsequent ovulation.

A survival value of ovulation from the side opposite that of the recent pregnancy may be inherent in this species, especially when mating occurs early after calving. In this study, when cows were served before uterine involution, those ovulating on the opposite side had higher conception rates, but the small number of observations precludes any conclusions.

Various reports have shown that more ovulations, and consequently more

pregnancies, occur on the right side in the bovine (Clark, 1936; Reece & Turner, 1938; Kidder, Barrett & Casida, 1952; Hafez & Sugie, 1963). This same trend was observed here, the ratios of the right to left activities of the uterus and ovaries being fairly constant.

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