FOLLICULAR DEVELOPMENT AND REPRODUCTIVE HORMONE CHANGES DURING POSTPARTUM ANESTRUS IN SUCKLED BEEF COWS[1]

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Summary

Twenty-six, Hereford × Angus, suckled cows were utilized to determine patterns of follicular development and associated changes in reproductive hormones during postpartum anestrus and first estrous cycles. Ultrasonography per rectum was used to monitor follicular size and detect ovulation. Dietary energy and(or) body condition influenced patterns of follicular development during postpartum anestrus. Follicular growth occurred in waves during this period in cows that were in adequate body condition and adequately fed, and follicular development appeared to be related to serum concentrations of luteinizing hormone and estradiol. Two distinct characteristics were associated with follicular development before the first postpartum ovulation. First, diameter of dominant follicles increased with successive follicular waves. Second, a large dominant follicle was present for an extended time before development of the first ovulatory follicle and appeared to be involved in the mechanism that initiates the first ovulation after calving.

(Key Words: Cattle, Postpartum, Ovarian Follicles, Ultrasonography.)

Introduction

Duration of postpartum anestrus determines when and if cows rebreed following calving, both of which heavily influence the profitability of beef cow/calf production. However, in terms of reproductive management, this period still presents problems for many producers. A better understanding of the events and mechanisms responsible for initiating the return to cyclicity after calving is needed before recommendations or programs can de developed that will help beef producers better manage this economically important period. Our objectives were to determine the patterns of follicular growth and relate those patterns to changes in reproductive hormone from calving to the first postpartum ovulation in suckled beef cows.

Experimental Procedures

Twenty-six Hereford x Angus cows were utilized to study the effects of pre- and postpartum levels of dietary energy on postpartum reproductive performance. A 2 × 2 factorial arrangement of treatments was used with cows receiving either 70 (L) or 150% (H) of the NRC recommended level of dietary energy either before and(or) after calving, resulting in four treatment combinations (L-L, L-H, H-L, H-H). Ultrasonography per rectum was used to monitor follicular size and detect ovulation. Ovarian scans were performed at 2-d

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intervals starting at 6 d postpartum, then daily from 25 d postpartum until 10 d after the second postpartum ovulation or until 150 d postpartum.

Patterns of follicular growth were classified according to the occurrence of follicular waves. A wave of follicular growth was defined as the synchronous development of a group of follicles that were first detected within 3 d of each other. Follicles were classified as dominant if they reached a diameter of ≥ 8 mm and exceeded the diameter of all other follicles within the follicular wave. Subordinate follicles were those that appeared to originate from the same follicular group as the dominant follicle and decreased in size within a few days after detection. Follicular growth was classified as wave-like only if all dominant follicles were first detected in association with one or more subordinate follicles.

Jugular blood samples were collected at 2-d intervals from calving until 24 d postpartum, then daily from 25 d postpartum until the end of the study. Serum samples were assayed to determine concentrations of progesterone and estradiol. On d 14, 42, and 70 postpartum, blood was collected every 15 min for 6 h via indwelling jugular catheters and assayed for concentrations of luteinizing hormone.

Results and Discussion

Thirteen (five L-H, two H-L, and six H-H cows) of 26 cows ovulated by 150 days postpartum. Two very distinct characteristics of follicular development appeared in all cows that ovulated. First, all cows exhibited increases in the diameter of dominant follicles of successive follicular waves as days postpartum increased. Secondly, a large dominant follicle was present for an extended time before development of the first preovulatory follicle. This follicle was detected longer and was larger in maximal diameter than other follicles detected before ovulation and appeared to be a result of or part of the mechanism that initiates cyclicity in suckled beef cows.

All cows in the H-H group ovulated after exhibiting wave-like follicular growth. Thus, it appeared that follicular growth occurred in waves during postpartum anestrus if cows were in adequate body condition and were receiving adequate nutrition. In the 13 cows that ovulated, regardless of treatment group, diameter of the largest follicle increased with successive follicular waves, as indicated by the correlation ($r = .50$, $P < .0001$) between diameter of the largest follicle and day postpartum. Follicular growth in one representative cow that ovulated is depicted in Figure 1.

All cows that ovulated had increases in serum estradiol preceding the first and second postpartum ovulations. Estradiol concentrations were correlated positively ($r = .20$, $P < .0001$) with diameter of the largest follicle and numbers of large (≥ 10 mm) follicles. However, serum estradiol did not appear to change in relation to the development of the last, dominant, non-ovulatory follicle.

Three of six cows in the L-H treatment group exhibited waves of follicular growth from parturition to the first postpartum ovulation. In the other three cows of this treatment group, a majority of follicular growth occurred in waves. However, the appearance of follicular waves was interrupted by large follicles that were not associated with any subordinate follicles. A majority of the follicular growth occurred in waves for all cows in the H-L treatment group.

None of the cows in the L-L group ovulated during the study, but two distinct patterns of follicular growth were detected. Three cows had patterns of follicular growth that were characterized as being partially wave-like. Four had no detectable waves of follicular growth and were classified as being random or continuous in nature. Few of the large follicles in cows in the L-L group were classified as dominant because they were not detected with a group of subordinate follicles. However, the pattern of growth of the large follicles in cows with partial wave-like follicular growth was similar to the growth and regression of dominant follicles in cows exhibiting waves of follicular growth.

Cows with partial wave-like follicular growth had detectable follicles much earlier postpartum and shorter intervals from calving to detection of a follicle $\geq$ 8 mm in diameter than the four cows with no follicular waves in the L-L group. It appeared that the partial wave-like follicular growth in L-L cows was due to a lack of subordinate follicles and not to a difference in the growth pattern of large follicles. The lack of subordinate follicles was probably a result of the nutritional treatments and possibly mediated through secretion of luteinizing hormone, because no cows in this treatment group exhibited pulses of luteinizing hormone at any of the sampling times. The other cows in the L-L treatment group with random patterns of follicular growth, exhibited more follicular development later after parturition, even though they were losing weight and body condition at that time. Thus, despite their poor body condition, they may have escaped some inhibitory effect or received some stimulatory influence later in the postpartum period.

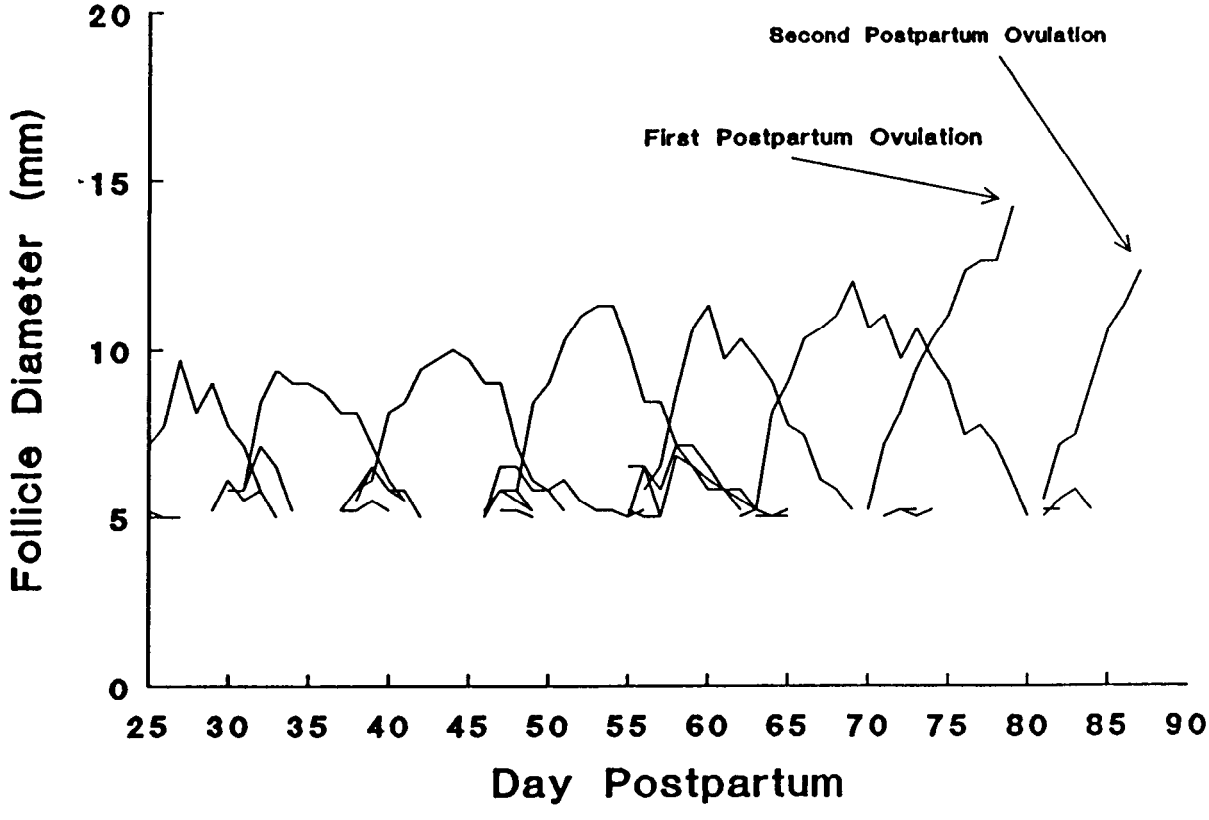

Figure 1. Waves of Follicular Growth from 25 Days Postpartum through the Second Postpartum Ovulation (Each Line Represents an Individual Follicle)