

Short Communication

Temporal relationships between minor, preovulatory, or periovulatory FSH surges and the emergence and development of 2-mm follicles of wave 1 in *Bos taurus* heifers



J.M. Baldryghi^{a,b}, M.A.R. Siddiqui^{a,b}, O.J. Ginther^{a,b,*}

^a Eutheria Foundation, Cross Plains, WI 53528, USA

^b Pathobiological Sciences Department, School of Veterinary Medicine, University of Wisconsin–Madison, 1656 Linden Dr, Madison, WI 53706, USA

ARTICLE INFO

Article history:

Received 12 April 2016

Received in revised form 18 May 2016

Accepted 19 May 2016

Keywords:

Follicle emergence

FSH minor surge

FSH preovulatory surge

FSH periovulatory surge

ABSTRACT

The number and day of emergence (first detection) of 2-mm follicles and the number and day when the 2-mm follicles reached 3-, 4-, 5-, and 6-mm during wave 1 were determined every 0.5 d ($n = 9$ heifers). Emergence of the follicles at each of the indicated diameters was normalized to the beginning and ending nadir and the peak of each of a minor FSH surge, the preovulatory surge, and the periovulatory surge. Relative to the day of ovulation (day 0), the minor FSH surge, preovulatory surge, and periovulatory surge encompassed (nadir to nadir) days -7.0 to -2.5 (peak, day -4.0), days -2.5 to -0.5 (peak, day -1.0), and days -0.5 to 4 (peak, day 0), respectively. Distinct mean nadirs occurred between the minor and preovulatory surges and between the preovulatory and periovulatory surges. A small percentage of 2-mm follicles (12%) and 3-mm follicles (2%) emerged during the minor FSH surge. The 4-mm follicles emerged during the preovulatory surge (24% of follicles) and periovulatory surge (76%). The 5-mm and 6-mm follicles emerged only during the periovulatory surge. The first increase ($P < 0.05$) in number of 2-, 3-, and 4-mm follicles began at 1.5, 1.0, and 0 d, respectively, before the nadir at the beginning of the preovulatory surge. The first increase ($P < 0.05$) in number of 5- and 6-mm follicles began at 0.5 and 0 d, respectively, before the intervening nadir between the preovulatory and periovulatory surges. Results demonstrated that each of the 3 surges including the minor surge contributed to the emergence of follicles at various diameters during wave 1. The emergence of 2-mm follicles during the descending portion of the minor surge indicated that smaller follicles (eg, 1 mm) apparently emerged during the major portion of the minor surge. The increasing diameter of the 2 largest follicles was not interrupted during the distinct intervening nadir between the preovulatory and periovulatory FSH surges.

© 2016 Elsevier Inc. All rights reserved.

1. Introduction

The emergence of each of the 2 or 3 follicular waves during an interovulatory interval (IOI) in cattle is stimulated by a surge in FSH [1]. The first 2 waves of an IOI are

termed waves 1 and 2, and the associated FSH surges are termed surges 1 and 2. Surge 1 has a preovulatory component (commonly called preovulatory surge) and a periovulatory component or surge [2,3]. The preovulatory surge is preceded by a minor FSH surge with a peak 4 d before ovulation or about 3 d before the preovulatory peak [2]. The FSH concentrations form a distinct common nadir that intervenes between the minor and preovulatory surges. When samples are collected frequently, the

* Corresponding author. Tel.: +1 608 798 3777; fax: +1 609 798 3722.

E-mail address: oj.ginther@wisc.edu (O.J. Ginther).

preovulatory and periovulatory surges are separated by an intervening nadir that is equivalent in FSH concentration to the nadir at the beginning of the preovulatory surge (Fig. 1) [3]. When samples are collected daily, surge 1 is often displayed as a single uninterrupted surge. In a study with hourly blood sampling and hourly ovulation determination, the interval from the peak of the preovulatory surge to ovulation was 26 h, and the peak of the periovulatory surge occurred at the hour of ovulation [3]. The hormonal control of the preovulatory and periovulatory surges has been reviewed [4].

In a study of wave 1 in heifers with ultrasound examinations everyday, 3-mm follicles began to emerge before the day of maximal concentrations of FSH (equivalent to ovulation) [5]. Even follicles as small as 1 mm respond to an increase in FSH [6]. However, the published FSH profiles did not display the 2 components of surge 1, despite sampling every 6 h. In a study with daily blood sampling, the preovulatory and periovulatory components of FSH surge 1 were not detectable, and the beginning nadir of surge 1 occurred 3 d before ovulation [5]. The emergence of 2-mm follicles preceded the FSH nadir by 2 d (about 1 follicle/wave) and 1 d (2 follicles/wave). The periovulatory surge stimulates 5-mm follicles as shown by suppressing the

surge with a follicular-fluid extract [7]. This has been supported by a study in which 2-mm follicles did not emerge at 5 or 6 mm until the day after ovulation [5].

These studies have shown that small follicles (eg, 2 mm) begin to emerge before an FSH increase in surge 1. However, the temporal relationships between emergence of 2-mm follicles and growth into 3-, 4-, 5-, and 6-mm follicles during each of the minor, preovulatory, and periovulatory FSH surges are unknown and were the objectives of the present study. The effect of the intervening FSH nadir between the preovulatory and periovulatory surges on the continued increase in diameter of the largest follicles was also considered.

2. Materials and methods

Nine Holsteins (*Bos taurus*) dairy heifers between 19 and 30 mo of age were used in the northern temperate zone during April 2015. Follicle and FSH data for these heifers were obtained from the records of a previous report on the systemic effect of FSH and intraovarian effect of the corpus luteum on complete regression vs recovery of regressing wave-2 subordinate follicles during wave 2 [8]. The previous report did not consider the relationships between the emergence of wave-1 follicles and FSH concentrations during the minor, preovulatory, and periovulatory surges. Housing, care, and feeding have been described [8]. Animals were handled in accordance with the US Department of Agriculture Guide for Care and Use of Agricultural Animals in Research. The heifers were not bred and had an apparently normal reproductive tract based on ultrasound examinations [9]. Length of IOI was consistently greater than 17 d. Ovulations were not induced or synchronized with exogenous hormones.

A duplex B-mode (gray-scale) and pulsed-wave color Doppler ultrasound scanner (Aloka SSD 3500; Aloka America, Wallingford, CT, USA) equipped with a linear array transrectal 7.5-MHz transducer was used for follicle measurement. Identity of individual follicles was maintained (follicle tracking) as described and validated [9,10]. The average of height and width of a follicle was obtained from the apparent maximal area from 2 separate well-focused frozen gray-scale images. Follicle diameter refers to antral diameter in that the point where the cursor bars cross was placed at the distinctive periphery of the antrum. Diameter of follicles that were 2.0 mm or larger was measured every 12 h from day 12 (day 0 = ovulation) of an IOI to day 4 of the next IOI to assure that the minor FSH surge [2] and the maximal FSH concentration of periovulatory surge would be encompassed. The 2 examinations on day 12, as an example, were designated day 12.0 (8 AM) and day 12.5 (8 PM). To reduce heifer exposure to the transrectal procedure and the operator's work load, measuring and maintaining identity of follicles smaller than 2.0 mm were not done. Follicle examinations were done by the same operator at the 12-h intervals throughout the study. Follicles in the 2-mm category (2.0 to 2.9 mm) and their subsequent development into larger follicles (3-, 4-, 5-, and 6-mm categories) were used to define all follicles of wave 1. Follicles that emerged at 2 mm before ovulation but did not continue to increase in

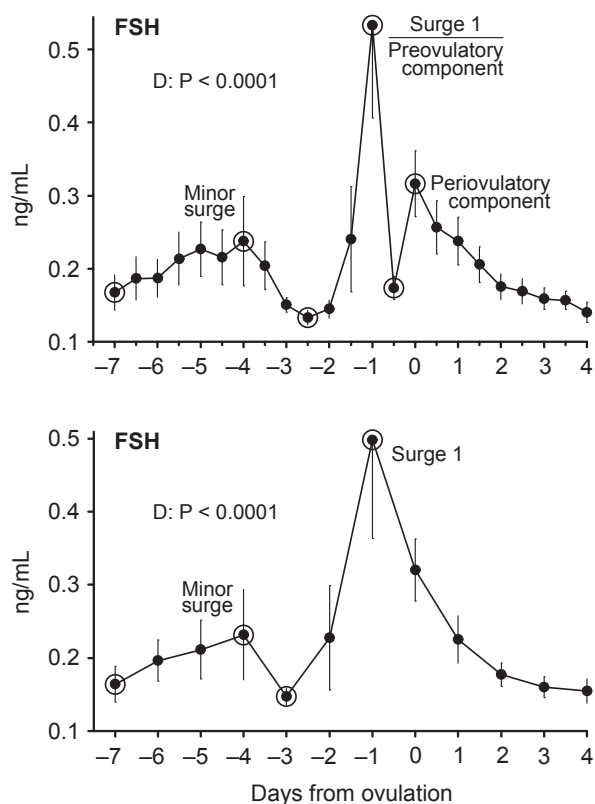


Fig. 1. Mean \pm standard error of the mean concentrations of FSH 7 d before to 4 d after ovulation showing the location of the minor surge and the 2 components of FSH surge 1 from samples taken at 8 AM and 8 PM (upper panel) and at 8 AM only (lower panel). The daily AM samples did not delineate the 2 components of surge 1 but well delineate the minor surge. An encircled mean indicates ($P < 0.05$) the beginning of an increase or decrease in concentration.

Download English Version:

<https://daneshyari.com/en/article/2393412>

Download Persian Version:

<https://daneshyari.com/article/2393412>

[Daneshyari.com](https://daneshyari.com)