Theriogenology 79 (2013) 1041–1044

Contents lists available at SciVerse ScienceDirect

Theriogenology

journal homepage: www.theriojournal.com

Effect of biostimulation and social organization on the interval from calving to resumption of ovarian cyclicity in postpartum Angus cows

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ARTICLE INFO

Article history:
Received 23 June 2012
Received in revised form 23 December 2012
Accepted 18 January 2013

Keywords:
Biostimulation
Male-effect
Social organization

ABSTRACT

The objective was to assess the effect of biostimulation by the male presence and social organization on the interval from calving to resumption of ovarian cyclicity (ICR). Thirty Angus cows were allocated according parity into three groups (10 per group); two groups were exposed to bulls, and a third group not exposed to bulls served as a control. Dominance values (with subsequent arc-sin transformation) were calculated from daily recorded agonistic interactions and later organized into dominance order comprising three social categories as follows: dominant (D), intermediate (I), and subordinates (S). The ICR was established by determining presence of luteal tissue and a rise of blood progesterone concentration above 1 ng/mL using ultrasonography and a solid-phase, nonextraction radioimmunoassay (Coat-a-Count; Diagnostics Products Corporation, Los Angeles, CA, USA), respectively. The effect of biostimulation, dominance order, and treatment by dominance order on ICR was statistically analyzed applying ANOVA using PROC GLM of SAS (2010). The ICR was influenced by biostimulation ($P < 0.002$) and dominance order ($P < 0.004$). The ICR increased as dominance order decreased ($D = 34.5 \pm 6$ days; $I = 45.0 \pm 6$; $S = 53.1 \pm 4$ days; $P < 0.01$). However, when comparing cows within social categories, ICR was reduced in the group exposed to bulls ($D = 26.3 \pm 8.2$ days; $I = 42.0 \pm 6.4$ days; $S = 46.1 \pm 4.1$ days) compared with those not exposed to bulls ($D = 43.0 \pm 8.2$ days; $I = 48.0 \pm 10.1$ days; $S = 60.2 \pm 6.4$ days) cows. In conclusion, biostimulation and social dominance influenced the ICR.

1. Introduction

Although the effect of biostimulation by the male presence and social organization on multiple aspects of cattle performance have been reported, studies exploring interactions between these social factors in cattle are scarce.

Biostimulation by male presence has been reported to exert an influence on the interval from calving to resumption of ovarian activity [1–5], luteal tissue functionality [3,6], estrus expression [7–10], and age at first pregnancy [11]. Conversely, several studies have reported the effect of social organization on aspects such as feed intake [12,13], weight gain [14–16], milk yield [17,18], and estrus expression [19].

Whereas the extent to which biostimulation can surpass nutritional influences on reproduction is not clear [11,20–22], the effect of social dominance on nutritional related-factors is clear [12–16]. Likewise, nutritional factors such as feed intake and weight gain are recognized factors capable of exerting influence on reproductive function [23–25]. Then, in conjunction with the influence of

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0093-691X/$ – see front matter
http://dx.doi.org/10.1016/j.theriogenology.2013.01.020

nutrition, social organization might exert an effect on reproductive function. Surprisingly, scientific information regarding the interaction of biostimulation and social organization appears to be absent.

The objective of this study was determine the combined effect of biostimulation caused by the male presence and social organization on the interval from calving to resumption of ovarian cyclicity in postpartum Angus cows.

2. Materials and methods

2.1. Animals

To assess the effect of social organization and biostimulation caused by bull exposure on the resumption of ovarian activity, during the spring season at the Santa Fe Beef Research Unit of University of Florida, 30 Angus cows (*Bos taurus)* from the university's herd were allocated according parity into three groups of 10 each (Table 1). The inclusion and exclusion criteria were: no history of reproductive problems, within 1 week after calving, absence of dystocia and/or other puerperal problems, presence of a healthy calf, and body condition score (BCS) no less than 4 (on a scale of 1 to 9) [26]. The time required for handling, restraining a cow into the chute, and performing bleeding and ultrasonography determined a limitation of 10 cows per group (i.e., 30 cows daily). However, using PROC POWER of SAS [27], we determined that 10 cows per group can provide at least 95% confidence and 70% power of detecting a difference of 10 days in the interval from calving to resumption of ovarian activity. To be used as teasers, two healthy, mature, and experienced Angus bulls of similar body frame and weight were epididectomized 1 month before starting the experiment. Each teaser bull was allocated to a group of 10 cows (BE) creating a replication to detect differences because of bull exposure, and a third group not exposed to a bull served as control (NE).

2.2. Handling and feeding

Each experimental group was confined in individual pens of approximately 0.25 hectares for 90 days. The NE group was isolated to prevent any type of stimuli from bulls and BE cows. To achieve such isolation, we took advantage of the irregular topography existing between pens plus a distance of approximately 70 m. All calves were kept with their dams to suckle throughout the study. All cows received daily prepartum and postpartum feed supplementation. Feed consisted of approximately 6 kg per cow of a mix of corn (1.2 kg), soybean meal (0.8 kg), coconut meal (0.8 kg), citrus pulp (3.2 kg), and trace minerals (0.13 kg). Three portable feeders of approximately 5 m length (bunk space of approximately 1 m per head) and double entry were used in each group to dispense the supplemental feed. In addition, during the study all cows in each group were fed Bahia grass (*Paspalum notatum)* hay and water *ad libitum*. No grass was available in any of the three assigned pens.

Table 1
Baseline comparison.

Group	Parity				
	1	2	3	4	Tot
A	2	3	4	1	10
B	2	2	5	1	10
C	2	3	4	1	10

Parity distribution among bull-exposed (A and B) and non-exposed (C) groups. There were no differences (P>0.05).

2.3. Procedures

To assess the social organization, at feeding time and until feed was over, observations regarding agonistic interactions (forced displacements at the feeders, flank attacks, butting, bunting, clinching, avoidances, and threats) within each group were recorded. Each agonistic interaction observed was recorded as a win or loss event. Agonistic interactions occurring around defensible resources (e.g., water tanks, hay dispensers, shadow areas) were also recorded. Dominance values were defined and calculated as the proportion of individuals dominated in relationship to the total of herdmates with a subsequent arc-sin transformation [28]. Dominance values were then organized into a simple linear and/or transitive arrangement to produce a dominance order comprising three social categories (e.g., dominant, intermediate, and subordinate). The number of individuals within social categories is shown (Table 2). When social organization was identified, the dominance order (i.e., social rank) of each individual was assigned and included in the statistical model. It should be understood that either fixing or predicting the number of animals within each social category is impossible.

All cows from the BE and NE groups were subjected to every other day ultrasonographic examination of ovaries and bleeding to determine presence of luteal tissue (yes or no) and blood progesterone concentrations, respectively. Blood samples were obtained by jugular venipuncture, placed in a container filled with crushed ice, and

Table 2
Effect of dominance order and biostimulation x dominance order (DO) on the interval from calving to resumption of ovarian cyclicity. Least square means ± Standard error (LSM ± SEM).

D.O.	N	LSM ± SEM (days)
Dominants	6	34.5 ± 6^{a}
Intermediate	7	$45.0 \pm 6^{a,c}$
Subordinates	17	$53.1 \pm 4^{b,c}$
Biost x D.O.		
Biost D	3	26.3 ± 8.2^{d}
Biost I	5	$42.0 \pm 6.4^{e,j}$
Biost S	12	$46.1 \pm 4.1^{f,j}$
N-Bio D	3	$43.0 \pm 8.2^{g,j,l}$
N-Bio I	2	$48.0 \pm 10.1^{h,j,l,n}$
N-Bio S	5	$60.2 \pm 6.4^{i,k,m,n}$

Abbreviations: Biost, biostimulation; D.O., Dominance order; D, Dominant; I, Intermediate; S, Subordinate.
$^{(a,b)}$ Differ ($P < 0.01$).
$^{(d,e)}$ Did not differ ($P < 0.14$).
$^{(d,f)}$ Differ ($P < 0.04$).
$^{(d,g)}$ Did not differ ($P < 0.17$).
$^{(d,h)}$ $^{(l,m)}$ Tended to differ ($P < 0.10$).
$^{(d,i)}$ Differ ($P < 0.003$).
$^{(j,k)}$ Differ ($P < 0.05$).