

Effect of Circulating Blood or Plasma Urea Nitrogen Concentrations on Reproductive Efficiency in Beef Heifers and Cows

A.S. Leaflet R3066

Patrick J. Gunn and Allie. L. Lundberg, Department of Animal Science, Iowa State University, Ames;
Robert A. Cushman and Harvey. C. Freetly, USDA, ARS, U. S. Meat Animal Research Center, Clay Center, NE;
Olivia. L. Amundson, Julie A. Walker, and George. A. Perry, Department of Animal Sciences, South Dakota State University, Brookings

Summary and Implications

The objective was to examine the relationship between circulating blood or plasma urea nitrogen concentrations (BPUNC) and reproductive efficiency in beef heifers and suckled beef cows. Data from nulliparous heifers ($n = 284$) as well as primiparous ($n = 241$) and multiparous ($n = 806$) beef cows were compiled across 15 experiments. A single blood sample collected from each female during estrous or ovulation synchronization was analyzed for BPUNC. Only females that were maintained on the same nutritional management scheme (pasture or coproduct-based drylot ration) for at least 1 week prior to synchronization through the first 21 days of the breeding season were included in the analysis. Based on the data, when cattle are allowed to adapt to a nutritional management scheme prior to breeding and maintained on that diet through the first 21 days of the breeding season, BPUNC is not negatively associated with first-service pregnancy rates. Instead, a positive relationship was observed.

Introduction

It has been well documented that the relationship between blood, plasma, or milk urea nitrogen and fertility in dairy cattle are negatively correlated, with increased levels of plasma urea nitrogen (> 19 mg/dL) and milk urea nitrogen (> 15.4 mg/dL) resulting in suppressed fertility. Although this relationship is not fully understood, likely contributing factors have been suggested including altered sperm transport, impaired oocyte competence, and uterine environment. While largely unfounded, it has been widely accepted that a relationship between plasma or blood urea nitrogen and fertility, similar to dairy cows, exists in beef cows. The objective of this study was to examine the relationship between circulating blood or plasma urea nitrogen concentrations and reproductive efficiency in beef heifers and suckled beef cows.

Materials and Methods

Blood samples from 15 experiments collected in 1,331 beef females (nulliparous $n = 284$; primiparous $n = 241$; and multiparous $n = 806$) during estrous or ovulation synchronization were analyzed for circulating BUNPC. All females included in the analysis had been adapted to their nutritional management scheme for at least one week prior to synchronization and were maintained on that scheme through the first 21 days of the breeding season. Ultrasound was used to establish both first service and overall breeding season pregnancy rates. Of the 1,331 females in which first service pregnancy rate was established, 954 females had overall breeding season pregnancy records.

Females were categorized as having blood or BUNPC above or below each integer from 10 to 25 mg/dL. The GLIMMIX procedure of SAS was used for pregnancy analysis. The model for each BPUNC classification analysis also included the fixed effects of age classification and nutritional management scheme. Interactions among fixed effects were not significant and removed ($P \geq 0.10$). Days postpartum at synchronization was included in the model as a covariate when applicable and experiment was included as a random effect. The CORR procedure of SAS was used to determine overall first service pregnancy relationship with BUNPC

Results and Discussion

Average first-service pregnancy rate across the dataset was 55.6%. Regardless of age and nutritional management scheme, a BPUNC that was associated with decreased pregnancy rates could not be established. In fact, there was a tendency for improved pregnancy rate as BPUNC increased ($P = 0.08$, $r = 0.05$; Figure 1) and cattle with BPUNC above 16 mg/dL tended to have greater pregnancy rates (57.0%) than those below 16 mg/dL (54.6%; $P = 0.07$; Table 1). There were no differences ($P \geq 0.16$) in pregnancy rates between cattle that had BPUNC above or below any other integer from 10 to 25 mg/dL. Data from this analysis suggest that no negative relationships exist between first service pregnancy rate and circulating BUNPC up to 25 mg/dL in beef heifers and cows. Moreover, a positive relationship was observed.

Based on these data, when cattle are allowed to adapt to a nutritional management scheme prior to breeding and maintained on that diet through the first 21 d of the breeding season, BPUNC is not negatively associated with first-service pregnancy rates. However, because dietary regimen of individual animals in this study was sustained from one week prior to through 21 days into the breeding season, the

effect of acute changes in blood or plasma urea nitrogen around the time of conception and implantation warrants further research.

Table 1. First service pregnancy rate of beef heifers and cows in relation to circulating blood or plasma urea nitrogen concentrations.

Circulating urea nitrogen, mg/dL	Classification ¹		P-Value
	Below	Above	
	First service pregnancy rates, % (no./no.)		
10	53.8 (100/186)	55.9 (625/1118)	0.35
11	54.4 (142/261)	55.9 (583/1043)	0.34
12	54.9 (204/371)	55.8 (521/933)	0.31
13	54.9 (262/477)	56.0 (463/827)	0.60
14	54.9 (312/568)	56.1 (413/736)	0.29
15	55.8 (383/686)	55.3 (342/618)	0.27
16	54.7 (434/794)	57.1 (291/510)	0.07
17	55.3 (481/869)	56.1 (244/435)	0.48
18	54.3 (515/949)	58.9 (209/355)	0.15
19	54.9 (546/995)	57.6 (178/309)	0.40
20	55.0 (574/1045)	57.9 (150/259)	0.22
21	55.2 (598/1084)	57.2 (126/220)	0.24
22	55.6 (624/1122)	55.5 (101/182)	0.32
23	55.5 (641/1155)	56.4 (84/149)	0.20
24	55.8 (660/1183)	53.7 (65/121)	0.74
25	55.9 (675/1207)	51.5 (50/97)	0.99

¹Females were classified as having circulating blood or plasma urea nitrogen concentrations above or below each integer from 10 to 25 mg/dL.

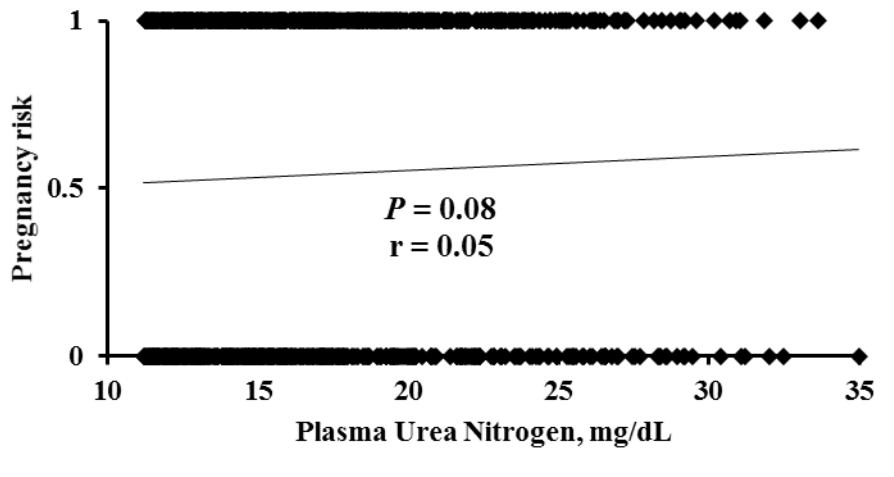


Figure 1. Relationship between circulating blood or plasma urea nitrogen concentration and first service pregnancy risk.