

Pro- and anti-inflammatory cytokines in the uterine environment throughout beef heifer development with supplemental protein



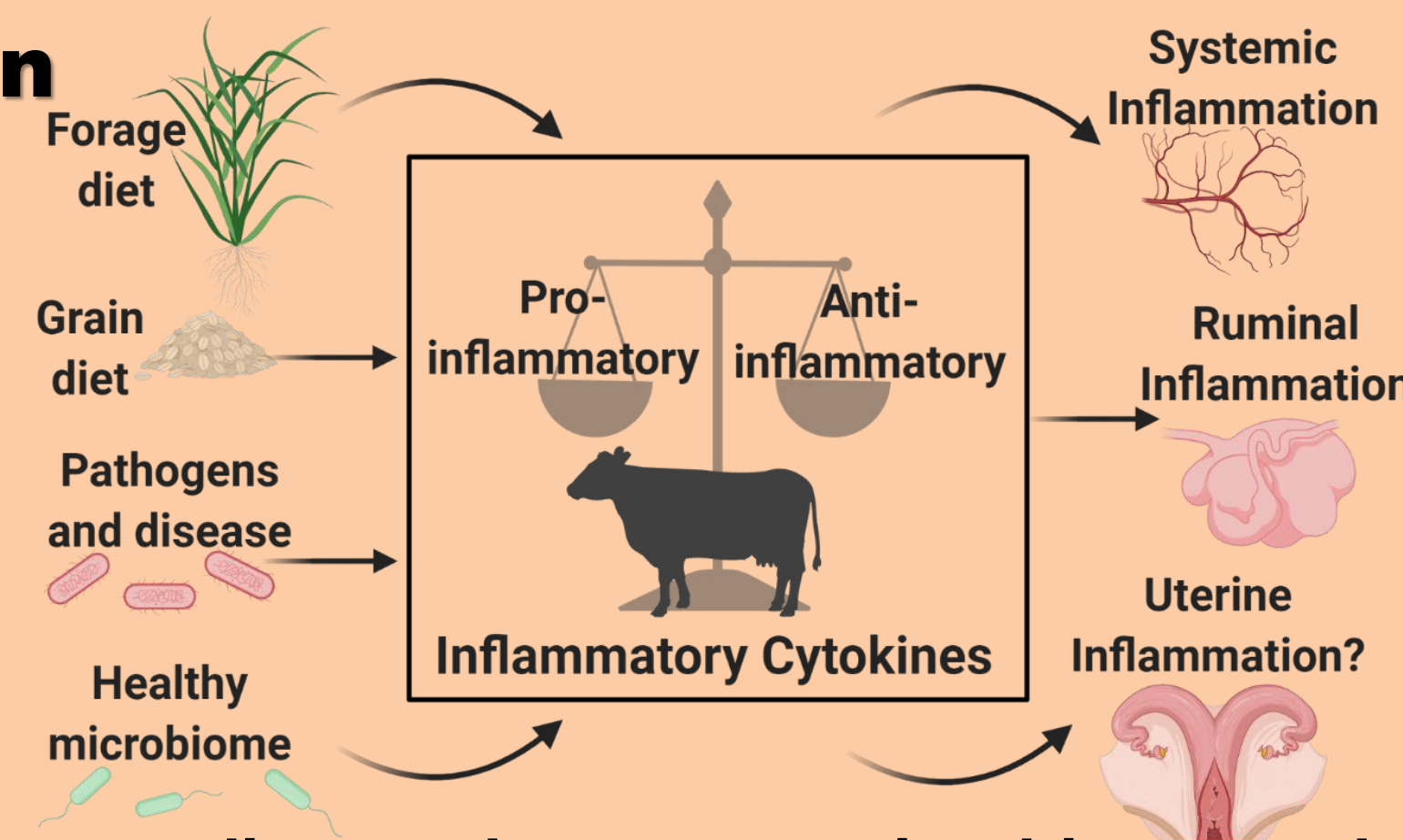
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Introduction

- Nutrition is a major factor in developing heifers to attain target body weight and puberty^{1,2}
- Different diets can disrupt the rumen microbiome and balance of inflammatory cytokines, eliciting ruminal and systemic inflammation^{3,4}
- Inflammatory cytokines contribute to many reproductive functions in the uterus⁵
- Nutritional strategies used to develop heifers, such as supplementation, may affect the inflammatory cytokines of the uterine environment and future reproductive performance



Methodology

Animals:

- 60 post-weaning commercial Angus heifers
- Ad libitum access to native grass hay, mineral, and water

Treatments:

Heifers blocked by body weight and randomly assigned to one of three levels of protein supplementation (n = 20 per group, n = 5 per pen) provided 4 times weekly for 6 months

1. 10% CP supplement (C; 100% corn)
2. 20% CP supplement (P20; 25% corn and 75% DDGs)
3. 40% CP supplement (P40; 25% DDGs and 75% soybean meal)

Sample Collection:

- Body weight, BCS, and blood every 2 weeks to monitor development
- Uterine fluid every four weeks for cytokine quantification
- Statistical analysis by GLIMMIX and frequency procedures in SAS 9.4

Results

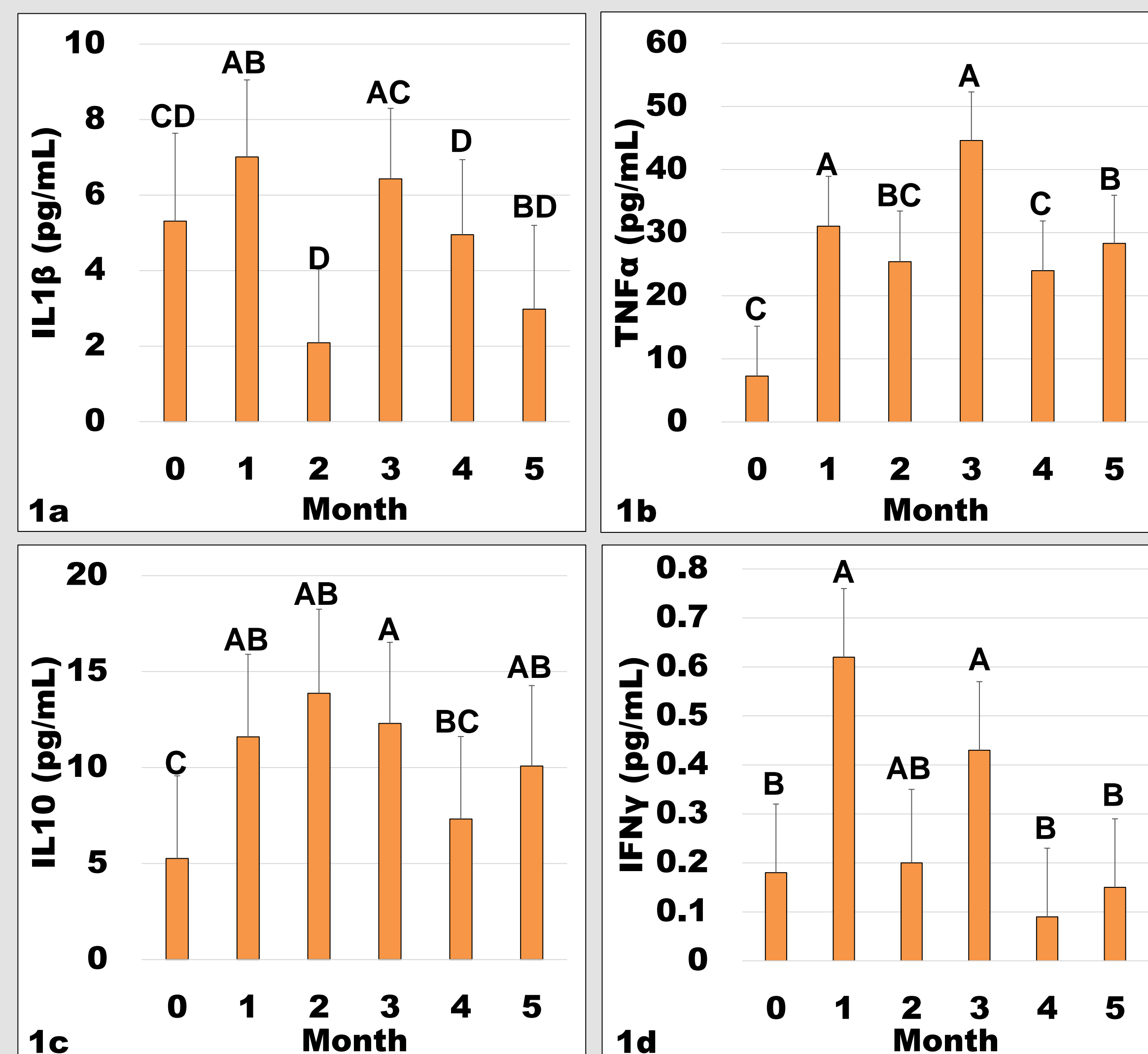


Figure 1. Mean concentrations of inflammatory cytokines across all months of heifer development. Interleukin-1β (1a), TNFα (1b), and IL10 (1c) concentrations shifted throughout development ($P < 0.0002$) with no effect of protein supplementation or their interaction ($P > 0.05$).

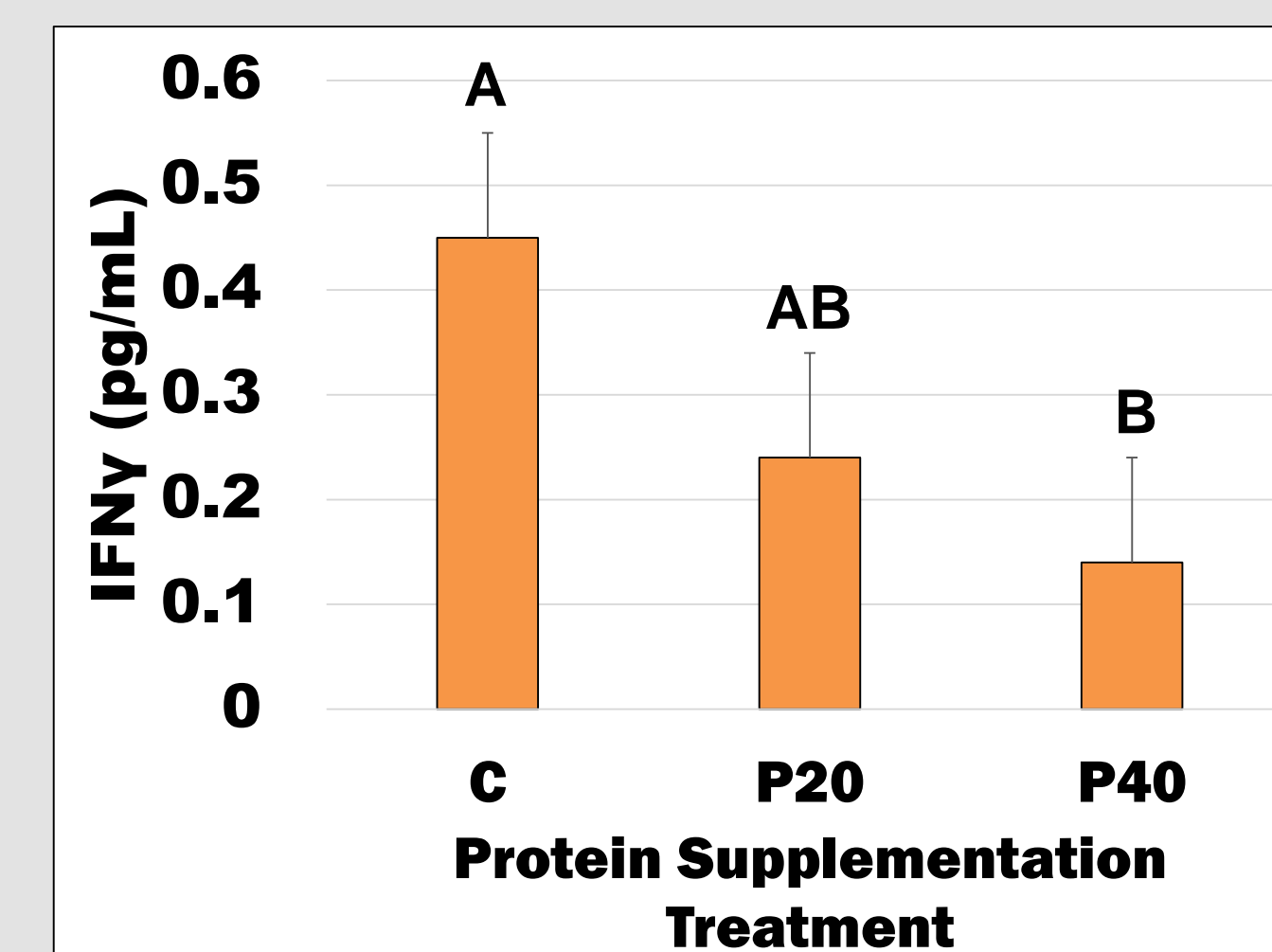


Figure 2. Mean concentrations of IFNγ shifted throughout development ($P = 0.002$; Figure 1d) with a tendency for an effect of protein supplementation ($P = 0.06$).

Table 1. Frequency of pro-inflammatory cytokines occurring together increased following protein supplementation. Anti-inflammatory IL10 presence was frequent in the presence of pro-inflammatory cytokines. The ratio represents the number of heifers with both cytokines present, over the number of heifers with cytokine present in the first column out of the 60 total heifers.

Present	Present	Month 0	Month 1	Month 2	Month 3	Month 4	Month 5
IL1α	IL1β	10/56	31/56	22/50	29/57	16/56	36/60
	TNFα	18/56	48/56	24/50	45/57	19/56	35/60
	IL10	18/56	40/56	35/50	52/57	24/56	31/60
IL1β	TNFα	8/10	30/31	15/22	35/38	12/16	29/36
	IL10	9/10	29/31	21/22	38/38	16/16	27/36
TNFα	IL10	13/18	39/48	23/24	44/45	17/19	30/35

Conclusions

- Cytokines fluctuated throughout development potentially in response to changing hormones as heifers achieved puberty
- Interferon-γ tended to be affected by level of protein
- Pro-inflammatory cytokines were frequently detected together after initiation of protein supplementation
- Interleukin-10 was frequently present with pro-inflammatory cytokines to balance level of inflammation
- Further research is needed to determine long term dietary influence on uterine environment and future reproductive success

Acknowledgments

The authors would like to thank Kevin Thompson and the Middle Tennessee Research and Education Center for help in collecting samples and providing care of the animals used in the study, and Dr. J. Lannett Edwards for her advice in experimental design and uterine flush techniques.

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