



Estimating glucose requirements of an activated immune system in Holstein steers¹

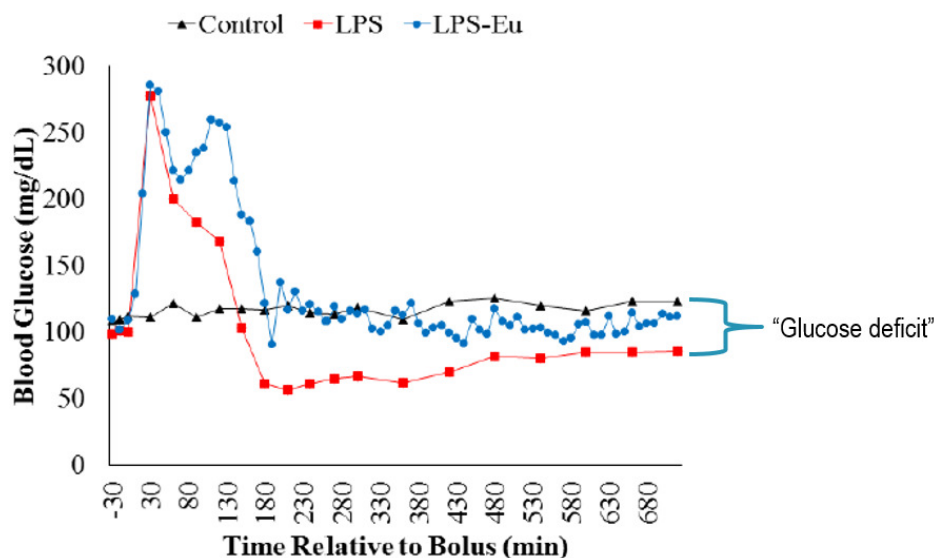
Animals experience frequent immune challenges, as bacterial insults can originate from many different situations. Economic consequences of sickness are due to decreased growth, inefficient feed utilization, poor reproduction, and increased health care costs. An activated immune system requires energy in the form of glucose and the literature suggests that glucose homeostasis is disrupted during an endotoxin challenge². The increased glucose need by the immune system occurs in addition to decreased nutrient intake and thus reduced intestinally derived carbohydrates. Consequently, there is a negative glucose balance that likely limits the immune response and certainly limits growth.

The objective of the study was to quantify the amount of glucose needed to maintain euglycemia (normal blood glucose level) during an immune challenge. It was hypothesized LPS challenged animals would require more glucose.

Materials and Methods

- 15 Holstein steers (148 ± 9 kg BW)
- Treatments
 - 1) Control: 10 mL IV sterile saline bolus; n=5
 - 2) LPS: 1.5 µg/kg BW LPS IV bolus; n=5
 - 3) LPS-Eu: 1.5 µg/kg BW LPS IV bolus + euglycemic clamp; n=5
- Feed was removed 1 h prior to bolus and animals remained fasted throughout the challenge
- 3 baseline blood samples were obtained and averaged to establish a target for euglycemia
- Blood samples were obtained -30, 0, 180, 360, 540, and 720 minutes relative to bolus for further analysis

Results



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Figure 1. Effect of saline (control), LPS infusion (LPS), or LPS infusion + euglycemic clamp (LPS-Eu) on blood glucose for all time points in fasted growing Holstein steers

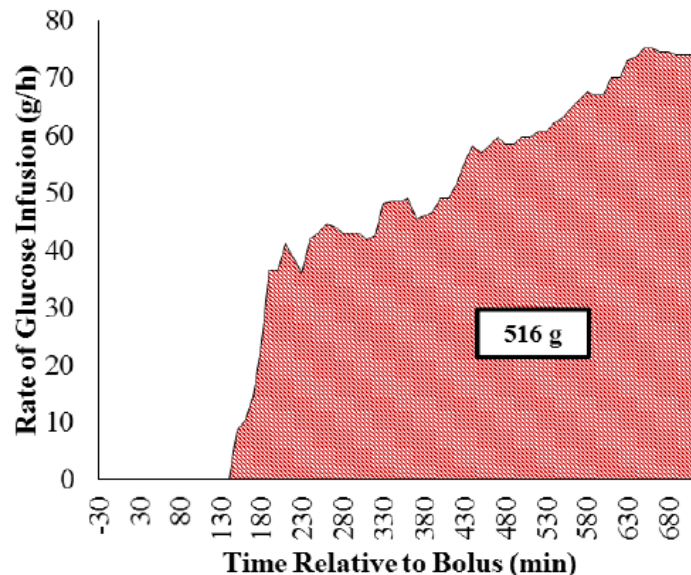


Figure 2. Rate of glucose infusion in LPS-Eu cows

Conclusion

- LPS administration reduced blood glucose, the number of circulating white blood cells, and ionized calcium levels (data not shown).
- Approximately 516 g of glucose was needed to maintain euglycemia in LPS-treated calves for the 12 h period.
- If the amount of glucose required to maintain euglycemia can be used as a proxy, then glucose requirements of an activated immune system are approximately 43 g/h in growing steers.

References

1. Sara K. Stoakes, Erin A. Nolan, David J. Valko, Mohannad Abuajamieh, Maria V. Sanz Fernandez, and Lance H. Baumgard. 2015. Estimating glucose requirements of an activated immune system in Holstein steers. *J. Anim. Sci.* Vol. 93, Suppl. s3/*J. Dairy Sci.* Vol. 98, Suppl. 2.
2. Leininger, M.T. et al. 2000. *Domest. Anim. Endocrinol.* 18:71-82.

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