Circulating serotonin (5-HT) concentrations are associated with failure of passive transfer in 3-5 day old dairy calves

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1- Background

- Calf morbidity and mortality remains a problem for the dairy industry[1]
- Failure of passive transfer (FPT) is associated with an increased risk of disease[2]
- Circulating serum serotonin (5-HT) was previously implicated in calf immunity[3]
- Further work is needed to investigate the precise role of 5-HT in calf immunity

2- Objective and Hypothesis

- Objective: To determine if 5-HT serum concentrations in 3-5 d old dairy calves were associated with FPT.

- Hypothesis: Circulating 5-HT concentrations would be different between calves with and without FPT.

3- Materials and Methods

- Animals and management
  - 3-5 day old dairy calves were enrolled (n = 418)
    - Holstein (n = 317) and Jersey (n = 101)
    - Male (n = 238); female (n = 180)
  - Individual housing
  - Received either colostrum replacer (n = 24), maternal colostrum (n = 193), or a mixture of both (n = 169); colostrum was tested for quality prior to feeding.
- Blood sampling
  - Blood samples collected from all 3-5 day old calves
  - Serum IgG determined using BRIX refractometer
  - **FPT defined as serum protein < 5.5 g/dL**
  - Serum 5-HT concentration determined using a commercial ELISA kit
  - **5-HT categorized into low (< 2502 ng/mL) and high (≥2502 ng/ml)**
- Statistics:
  - Logistic regression was used to determine if FPT (yes or no; outcome) was associated with 5-HT (high or low; predictor)
  - Model initially controlled for potential confounders: sex, breed, colostrum type, and dystocia

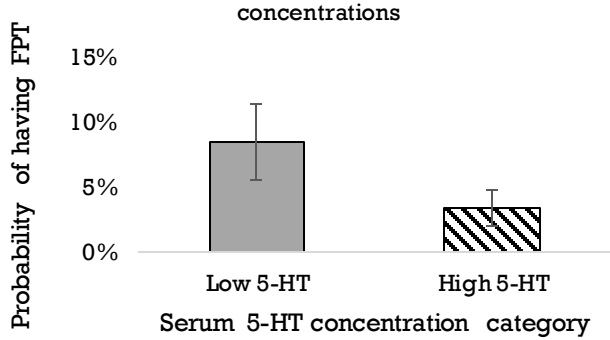
4- Results

- Sex, breed, colostrum type, and dystocia were not associated with FPT and were removed from the model ($P \geq 0.08$)
- 3% (6/210) of calves with high 5-HT concentrations had FPT (Table 1)
- 8% of calves with low 5-HT had FPT (Table 1)
- **Calves with low 5-HT concentrations had 2.7 (95% CI: 1.2-7.1) greater odds of having FPT compared to calves with high serum 5-HT concentrations ($P = 0.04$; Fig 1)**

Table 1: 2x2 table showing the number of calves with and without FPT, by serum 5-HT concentration

	FPT = no	FPT = yes
High 5-HT	204	6
Low 5-HT	193	16

Fig 1: Predicted probability of having FPT for calves with low and high serum 5-HT concentrations



5- Conclusions

- **Higher serum 5-HT concentrations were associated with successful passive transfer, but the causal pathway is unknown.**
- Caution should be used when interpreting our results due to the low sample size in some categories.
- Furthermore, it is possible that 5-HT concentrations are higher in some calves because they had successful passive transfer. We are unable to determine this with our study, as pre-colostral blood samples would be required.
- Further investigation is needed to determine the precise relationship between 5-HT and FPT. Future work should include blood samples at multiple timepoints throughout calfhood.

- References: [1] USDA NAHMS. (2014). "Health and Management Practices on U.S. Dairy Operations, 2014."
- [2]Beam, A., Lombard, J., Kopral, C., Garber, L., Winter, A., Hicks, J., & Schlater, J. (2009). Prevalence of failure of passive transfer of immunity in newborn heifer calves and associated management practices on US dairy operations. *Journal of Dairy Science*, *92*(8), 3973–3980. doi: 10.3168/jds.2009-2225
- [3]Hernández-Castellano, L. E., Özçelik, R., Hernandez, L. L., & Bruckmaier, R. M. (2018). Short communication: Supplementation of colostrum and milk with 5-hydroxy-l-tryptophan affects immune factors but not growth performance in newborn calves. *Journal of Dairy Science, 101*(1), 794-800. doi:10.3168/jds.2017-13501

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