

Impact of housing management in horses using hair cortisol as a biomarker

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INTRODUCTION

- Horses are typically housed in individual stalls or in similar groups with respect to age and sex in an effort to avoid possible injury from aggressive interactions [1] [2].
- Confinement and social isolation may contribute to the activation of the stress response [2].
- Chronic stress causes an elevated baseline of HPA activity [3].
- Prolonged effects of the hormones in the stress system can lead to health issues and disorders [3].
- Traditional cortisol measurements give acute and short-term circulating levels of cortisol. Utilizing hair cortisol will allow a reflection of long-term cortisol concentrations [4].

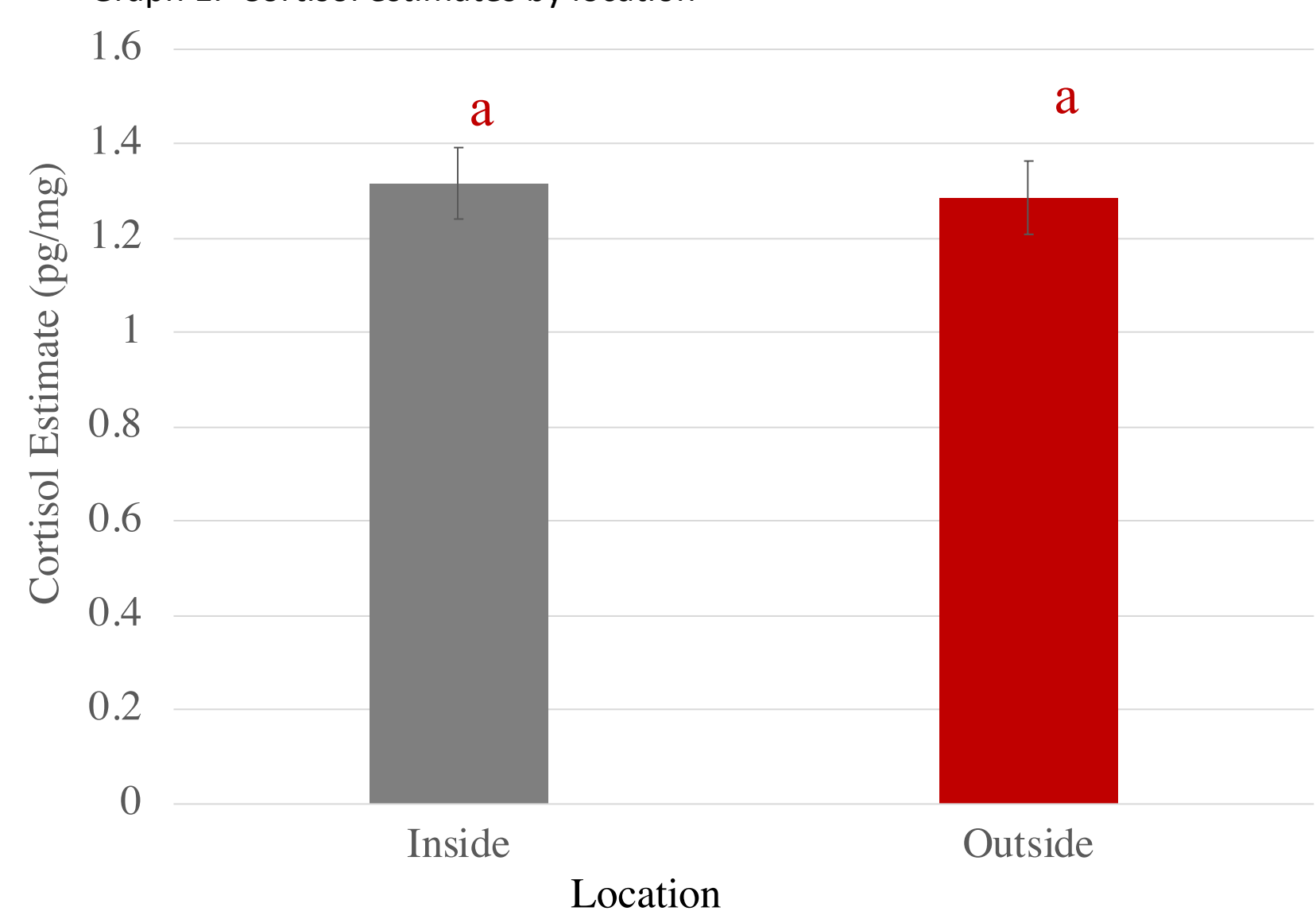
OBJECTIVE

- Determine if there is an effect of housing on long-term hair cortisol in horses transitioned from outdoor group housing to individual housing in box stalls.
- Determine if a correlation exists between cortisol and HR, behavior, and reactivity.

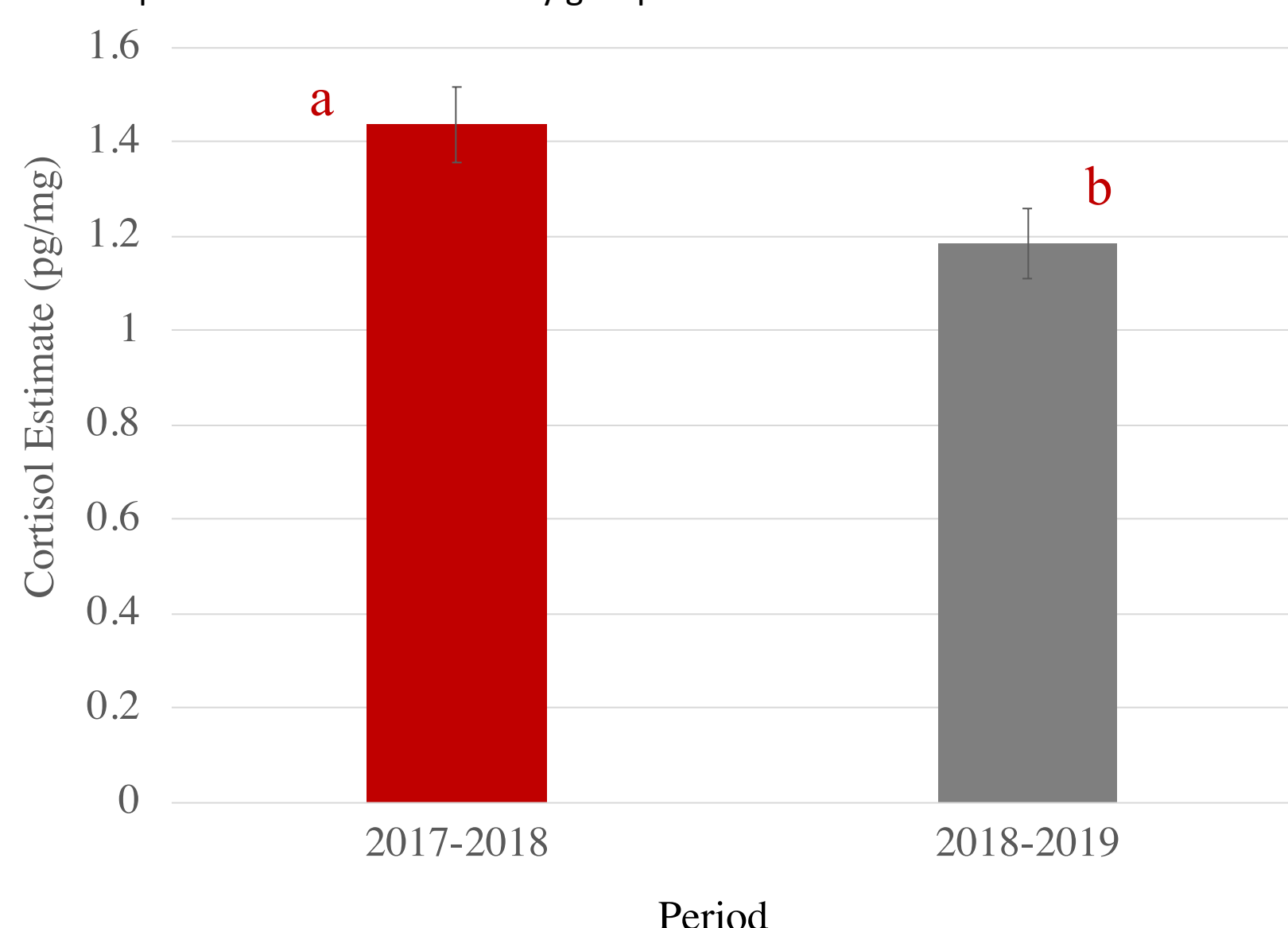
MATERIALS & METHODS

- 11 Quarter Horses (3.59 ± 1.36 yr) consisting of five mares and six geldings housed at The Ohio State University equine facility.
- Two periods were analyzed: school years 2017-2018 and 2018-2019; Months of October – March.
- Hair samples were collected from the top of each horse's poll in sections of two inches.
- Results were analyzed using Proc Mixed in SAS 9.4 with a random statement of horse and repeated month.
- Hair cortisol was analyzed at The Ohio State University College of Nursing with an ELISA.
- Five of the period 2 horses were used in novel object and sensory sensitivity tests.

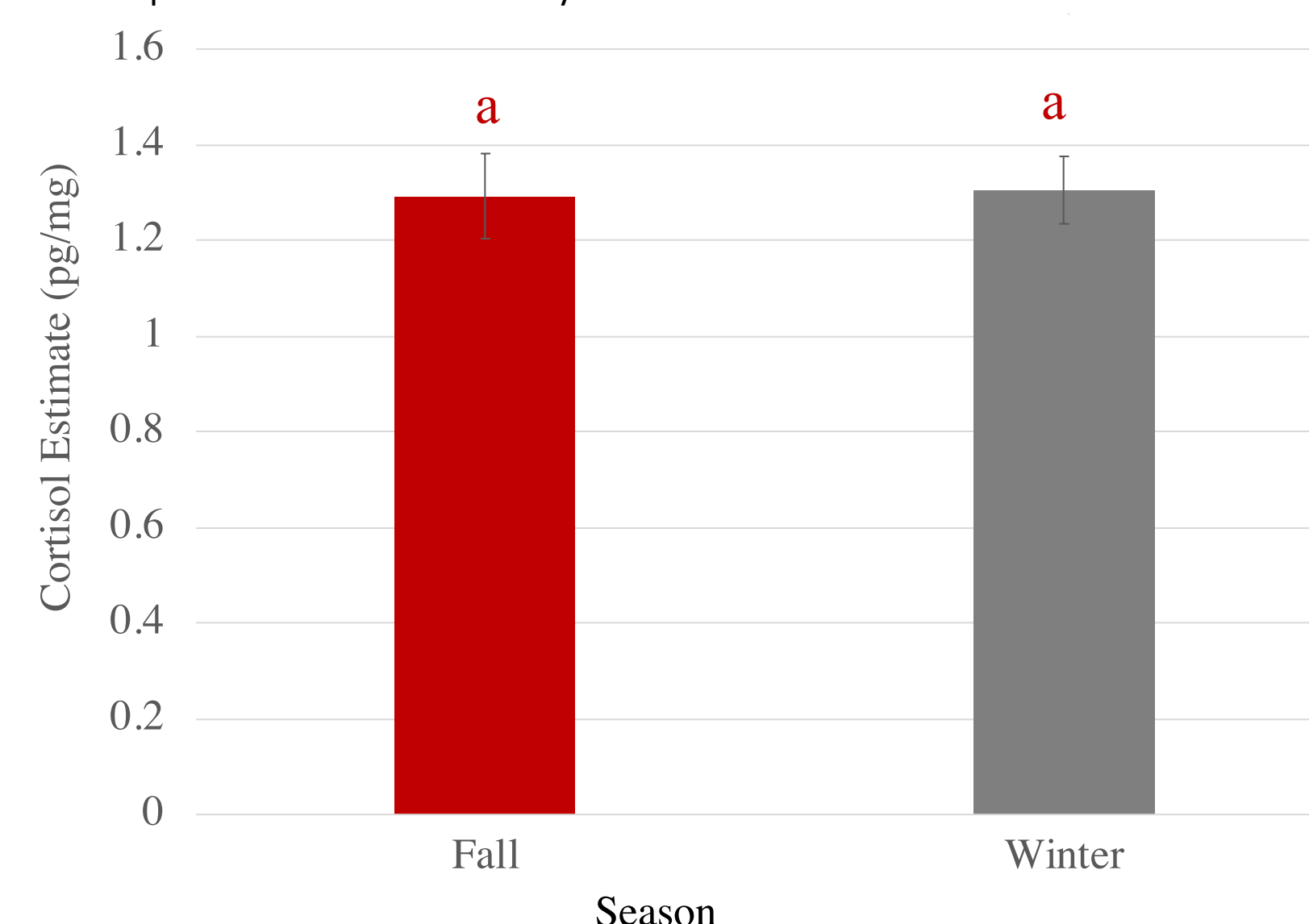
Graph 1. Cortisol estimates by location



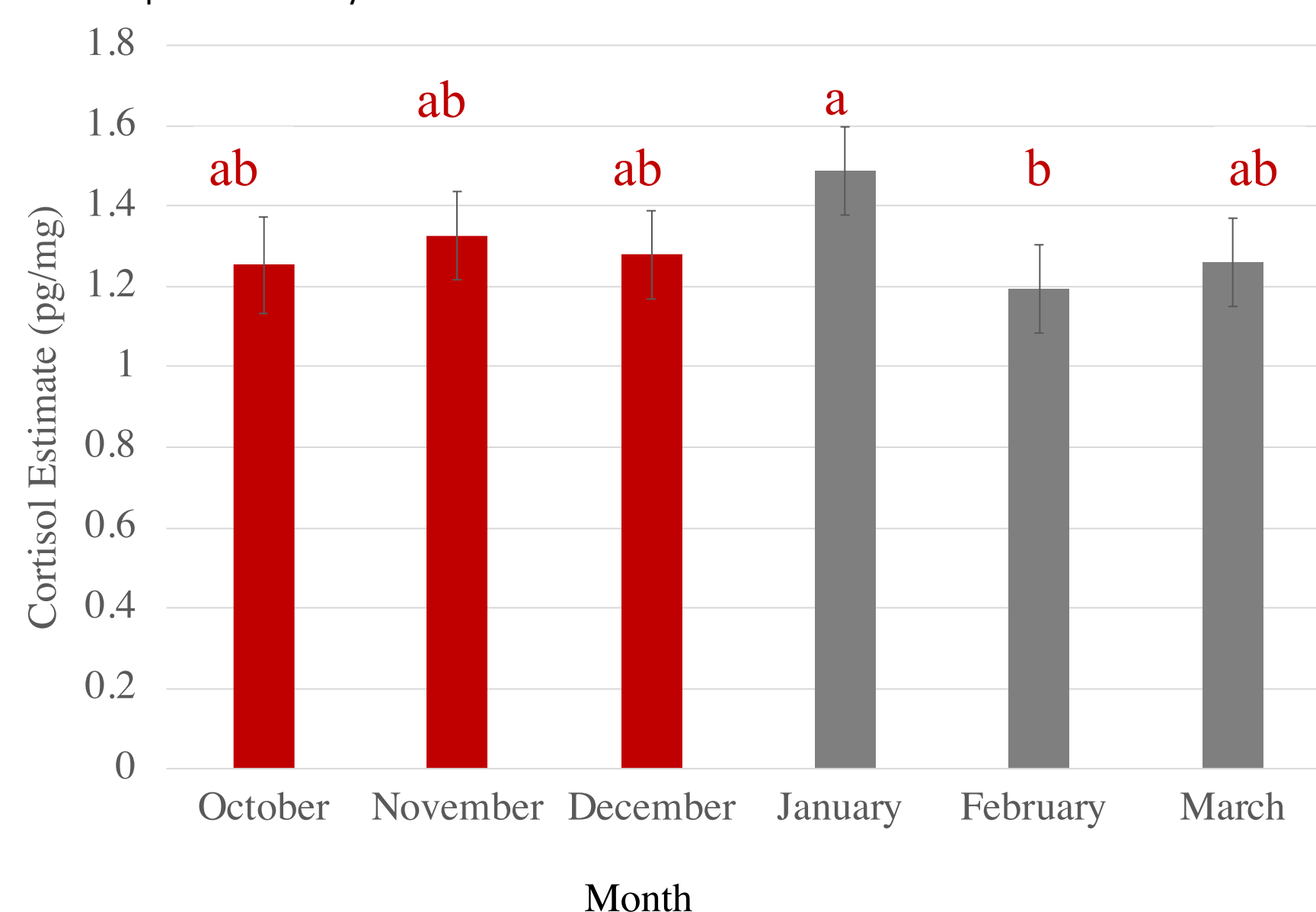
Graph 2. Cortisol estimates by group



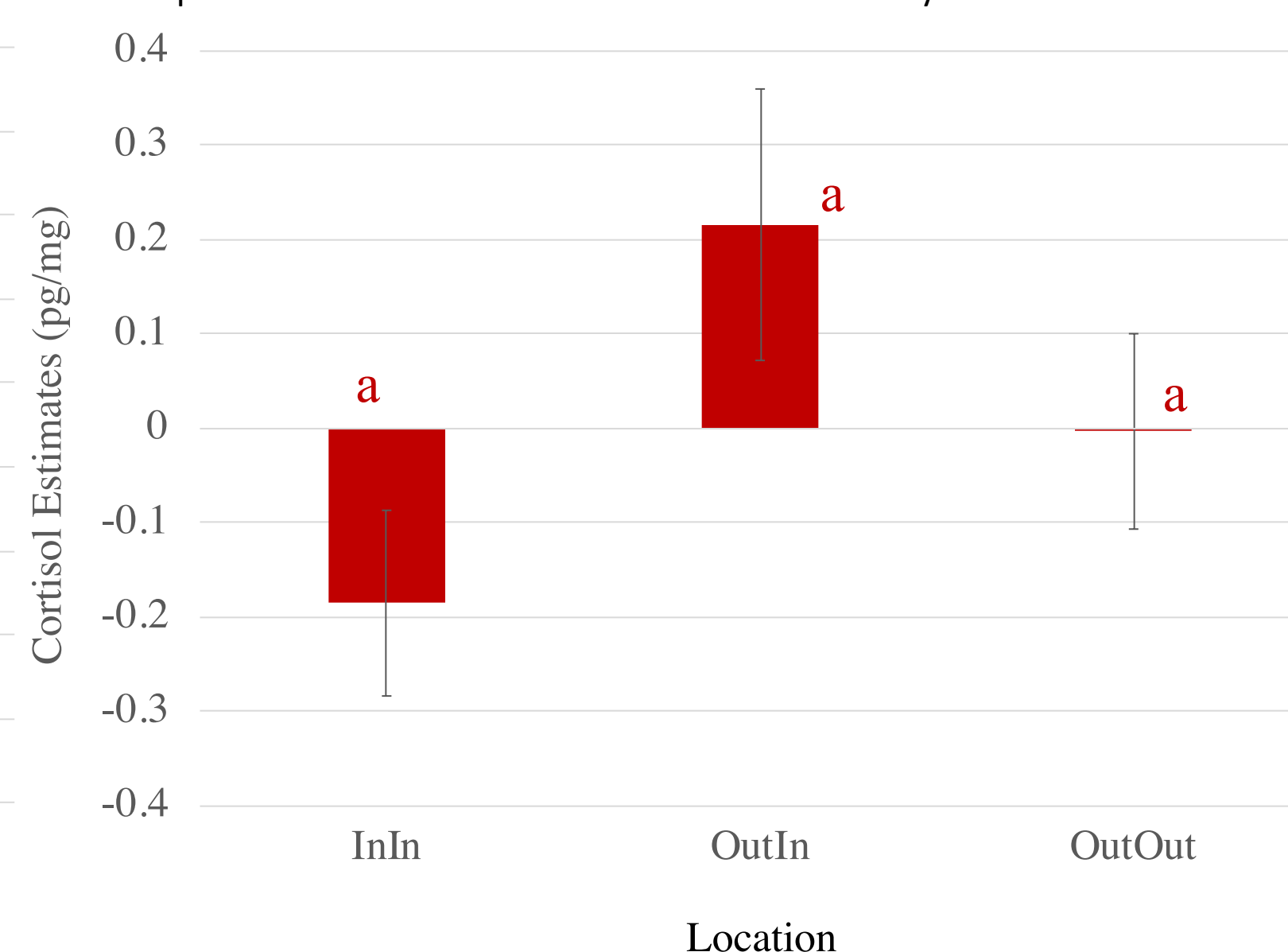
Graph 3. Cortisol estimates by season



Graph 4. Monthly cortisol estimates



Graph 5. Individual variation of cortisol estimates by location



Graph 6. Individual variation of cortisol estimates by month

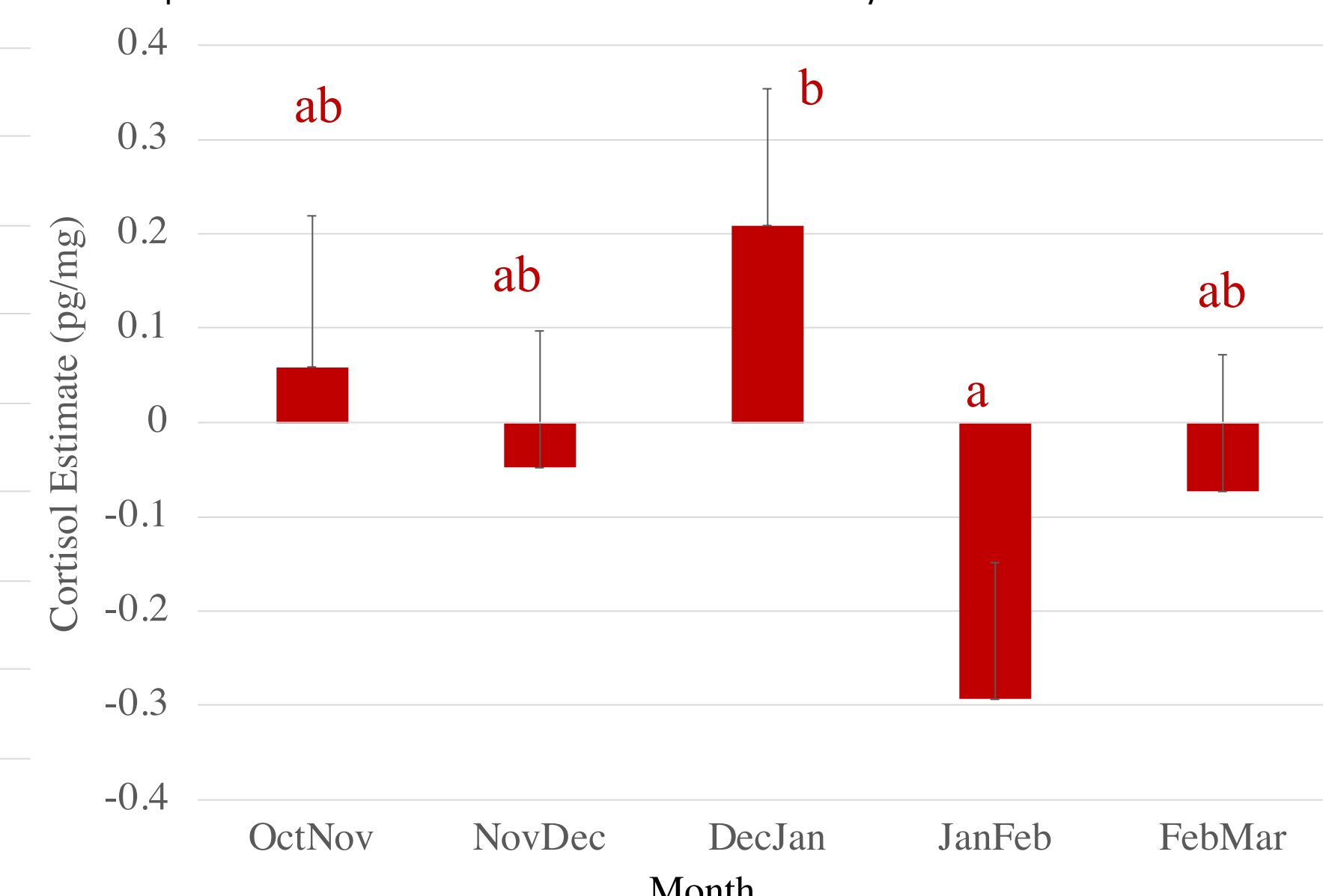


Figure 1. Correlations for novel object tests and average hair cortisol concentration

Variables	1	2	3	4	5	6
1. HR Baseline	---					
2. HR Umbrella	0.27411 0.1007	---				
3. Behavior Umbrella	-0.05087 0.737	-0.41744 < 0.0001	---			
4. HR Pool Float	0.36107 0.0137	0.66815 < 0.0001	-0.40497 < 0.0001	---		
5. Behavior Pool Float	-0.29459 0.0495	0.16693 0.1245	-0.02777 0.7796	0.08255 0.4048	---	
6. Average Cortisol	-0.26903 0.0706	-0.21860 0.0419	0.02478 0.8019	-0.44413 < 0.0001	-0.22254 0.0232	---

Correlation is significant at the 0.05 level. Analyzed in SAS 9.4 with Pearson Correlation Coefficients with variables of HR baseline, HR umbrella, behavior umbrella, HR pool float, behavior pool float, and average cortisol concentration.

Figure 2. Correlations for sound sensory sensitivity tests and average hair cortisol concentration

Variables	1	2	3	4	5
1. HR Elephant	---				
2. Reactivity Elephant	0.61738 < 0.0001	---			
3. HR Hammer	0.34673 0.0196	0.25645 0.089	---		
4. Reactivity Hammer	0.27106 0.0717	0.2973 0.15884	0.29059 0.0528	---	
5. Average Cortisol	0.21249 0.1611	0.0785 0.6083	0.2874 0.0556	0.43108 0.0031	---

Correlation is significant at the 0.05 level. Analyzed in SAS 9.4 with Pearson Correlation Coefficients with variables of HR elephant, reactivity elephant, HR hammer, reactivity hammer, and average cortisol concentration.

RESULTS & DISCUSSION

- Results indicate that whether these horses were housed in outdoor conditions with conspecifics or inside in individual box stalls, the hair cortisol concentrations were not significant ($p > 0.05$).
- In contrast with fecal cortisol studies in which the short-term cortisol response was analyzed, horses showed an increase in cortisol concentrations while housed in total isolation and a trend of increased cortisol concentrations as social isolation increased [5].
- In agreement with a previous study utilizing plasma cortisol, the hair cortisol concentrations of these horses in the novel object and sensory sensitivity tests did not always reflect the animal's behavioral responses [6].

CONCLUSION

- Housing types utilized in this study for these horses does not change their long-term cortisol concentrations.
- Physiological measurements do not always reflect a horse's behavioral response and all should be utilized in studies attempting to indicate markers of chronic stress.

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