

Effects of *Mannheimia Haemolytica* Vaccination (One Shot®) on Feed Intake, Feed Efficiency, and the Acute-phase Protein Response of Heifers

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Mannheimia haemolytica vaccination results in a marked acute phase protein reaction, which is associated with reduced average daily gain and poorer feed efficiency.

Summary

Twenty-three weaned heifer calves (*Brahman x British*) were used in a completely randomized design with two treatments, 1) vaccinated (One Shot®; *Mannheimia haemolytica*, Pfizer Inc.; $n = 12$), and 2) saline-injected control ($n = 11$). Injections were administered subcutaneously at a volume of 2 mL. Heifers were allowed free choice access to a complete diet using an automated feed intake measuring system (GrowSafe®; Model 4000E). Following vaccination, blood samples were collected for determination of the acute phase reaction on d 0, 3, 6, 9, 12, and 15. Individual body weight was determined following a 12 h feed and water withdrawal on d 0 (d of vaccination) and d 16 (end of study). Initial and final body weight did not differ ($P > 0.36$) among control and vaccinated heifers (505 ± 69.5 and 540 ± 71.6 lb on d 0 and 16, respectively; standard error of mean (SEM) = 9.8). Plasma concentrations of ceruloplasmin and haptoglobin increased ($P < 0.05$) sharply in vaccinated heifers, but not saline-injected control heifers. Daily dry matter intake did not differ ($P = 0.66$) among treatments (20.5 vs. 19.4 lb/d for control and vaccinated heifers, respectively; SEM = 0.74); however, average daily gain (ADG) and gain:feed (G:F) was greater (P

≤ 0.05) for control vs. vaccinated heifers (2.54 vs. 1.94 lb/d, and 0.14 and 0.10 kg for ADG and G:F, respectively; SEM = 0.141 and 0.011). These data indicate that calves administered a *Mannheimia haemolytica* vaccination (One Shot®) experience an acute phase protein reaction that is associated with reduced ADG and poorer feed efficiency.

Introduction

Cattle undergo a variety of stressors within normal production processes. Vaccination, for example, is a normal beef production practice that is known to induce inflammation, which may also contribute to stress. The ability to link the influence of stress to livestock performance has been an essential but difficult task. An occurrence of stress may be defined in many ways, in general; it is described as any condition, derived from an animal's environment, which causes its homeostasis to be altered. In many cases, this altered homeostatic event initiates the inflammatory response. This may, or may not, result in clinical disease. It is the animal's ability to readily respond and adapt to the stress stimuli, which ultimately decides the disease outcome. In an attempt to return to a normal homeostatic state, a broad cascade of

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physiological processes takes place. One of the early and immediate responses to stress, which precede most other immunological processes, is the pro-inflammatory, acute phase reaction. A key component of the acute phase reaction is the production of a group of proteins collected referred to as the acute phase proteins. These proteins are derived from the liver in response to a group of proteins called the pro-inflammatory cytokines. The pro-inflammatory cytokines are dynamic in their ability to orchestrate a broad range of physiological responses, including impacts on apatite, muscle and fat tissue deposition and turnover, and attainment of immunity. In an effort to better understand how vaccination programs may impact short-term beef calf performance, we undertook this study with the objective to assess the effects of *Mannheimia haemolytica* vaccination on individual voluntary feed intake, feed efficiency, and the acute phase protein reaction in beef heifers.

Materials and Methods

This study was conducted at the UF-IFAS, North Florida Research and Education Center, Marianna. Weaned Brahman x British heifers ($n = 23$; average body weight = 505 ± 69.5 lb), without previous exposure *Mannheimia haemolytica* vaccination, were randomly allotted to receive either Vaccine ($n = 12$; *Mannheimia haemolytica* vaccination, 2 mL subcutaneous; One Shot®, Pfizer Inc.), or Control ($n = 11$; sterile saline 2 mL subcutnaeous). Heifers were maintained in a common pen and provided individual, free-choice access to a total mixed ration (12 and 54% crude protein and total digestible nutrients, respectively) using the GrowSafe® feeding system (Model 4000E). Heifers were

acclimated to the diet and GrowSafe® feeding system for 14 d prior to the start of the experiment. Relative to vaccination, blood samples were collected on d 0, 3, 6, 9, 12, and 15. Heifer ADG was calculated from individual body weights collected on d 0 and 16 following a 12 h withdrawal from feed and water. To assess the impact of vaccination on the acute phase protein reaction, plasma concentrations of ceruloplasmin and haptoglobin were determined.

Data were analyzed using the MIXED procedure of SAS. The model statement included treatment, day, and the interaction. Mean separation was performed using PDIFF and all results are expressed as LS means.

Results

Plasma ceruloplasmin and haptoglobin concentrations increased in vaccinated calves and were greater than saline-injected control calves on d 3, 6, 9, and 12 (ceruloplasmin), and d 3 (haptoglobin), respectively (Figure 1). Individual heifer dry matter intake did not differ ($P = 0.66$) among vaccinated and control calves; however, vaccinated calves had reduced ADG ($P < 0.05$; Table 1). Thus, feed efficiency was almost 30% poorer for vaccinated vs. non-vaccinated calves during the 14-d evaluation period.

These results suggest that *Mannheimia haemolytica* vaccination (One Shot®) results in a marked acute phase protein reaction in beef calves, which is associated with reduced ADG and feed efficiency.

Table 1. Effects of *Mannheimia haemolytica* vaccination on performance of beef heifers.¹

Item	Vaccinated	Control	SEM ²	P-value
Dry matter intake, lb/d	19.4	20.4	0.74	0.66
Average daily gain, lb/d	1.93	2.52	0.14	< 0.05
Feed efficiency (G:F)	0.103	0.135	0.0113	0.05

¹Vaccinated = *Mannheimia haemolytica* vaccine, 2 mL s.q.; One Shot®) and Control = sterile saline 2 mL s.q.). Heifers provided individual, free-choice access to a total mixed ration using the GrowSafe® feeding system. Values are presented as least squares means estimates.

²Standard error of the mean.

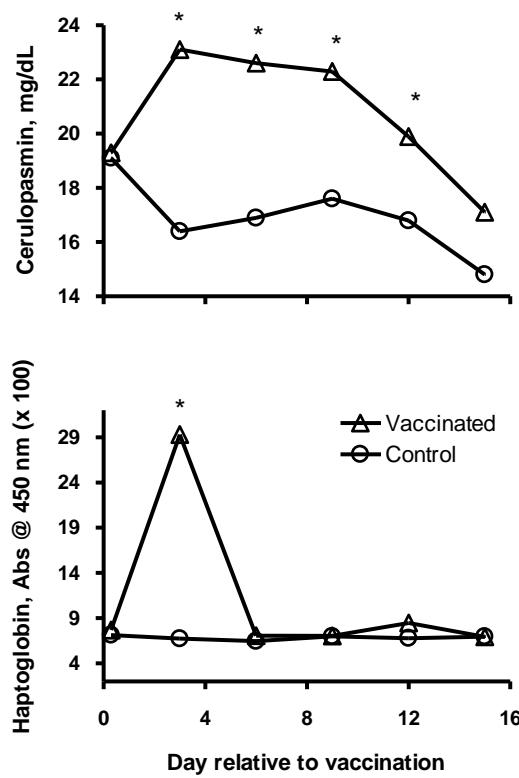


Figure 1. Effects of *Mannheimia haemolytica* vaccination on the acute phase protein reaction in beef heifers. * = means differ; $P < 0.05$.