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Yeast Derived Beta Glucans Can Support Modulation of the Equine Immune System During a Challenge

A SUMMARY OF RESEARCH CONDUCTED AT CORNELL UNIVERSITY BY PURINA ANIMAL NUTRITION EVALUATING THE ABILITY OF A YEAST DERIVED BETA GLUCAN TO MODULATE THE IMMUNE SYSTEM OF THE HORSE DURING GLUCOCORTICOID CHALLENGE.[1,2]

< INTRODUCTION >

Horses constantly encounter circumstances that challenge their immune health. Pathogenic exposure, exercise or travel-induced stress, age and metabolic status all play a role in the development of disease. Recently, nutrition has been implicated for its ability to positively impact the equine immune system, however the overall efficacy of specific additives has yet to be fully elucidated. Yeast-derived beta glucans have been implicated for their role in modulating the immune response[3]. The objective of the study was to evaluate the potential for a beta 1-3, 1-6 glucan supplement to modify the immune response in horses challenged through a glucocorticoid induced model of immune suppression. It was hypothesized that supplemented horses would have an altered immune response to a glucocorticoid challenge as demonstrated by immune cell proliferation and activation.

< MATERIALS AND METHODS >

Sixteen mares were randomly assigned to one of four groups, a base diet (Purina® Strategy® fed at 0.5% BW) with no supplementation (CON; n=4), base diet + 1 mg/kg BW beta glucan (LOW; n=4), base diet + 2 mg/kg BW beta glucan (MID; n=4), and base diet + 4 mg/kg BW beta glucan (HIGH; n=4). Horses were acclimated to the experimental housing for 2 days and baseline blood samples were then obtained at day 15. Horses then received dietary supplementation for 15 days prior to glucocorticoid challenge. A glucocorticoid challenge (0.1 mg/kg BW) was administered intravenously on day 16 and blood samples were obtained at 0, 8, 24, and 48 hours post challenge. Blood samples were analyzed for neutrophil and lymphocyte counts, serum ACTH and cortisol levels, lymphocyte subpopulation distribution ($CD4^+$ T cells, $CD8^+$ T cells, B cells, CD4/CD8 ratio) and leukocyte LFA-1 and MHC class II expression via flow cytometry. The data were analyzed via ANOVA to determine differences due to time and treatment and time by treatment interactions utilizing the GLIMMIX procedure in SAS 9.4 (Cary, NC).

< RESULTS >

Glucocorticoid administration resulted in an increase in neutrophil and decrease in lymphocyte numbers at 8 hours post administration indicating that the immune challenge was successful in suppressing the immune system. Cortisol response to glucocorticoid administration was depressed at 8 and 24 hours post injection and began returning to baseline at 48 hours post

[1] HR 252- The effects of beta glucan on immune function in horses.
[2] RD Jacobs, MB Gordon, RH Raub, MJ Felippe. Beta 1-3, 1-6 Glucan Supplementation Modulates the Immune Response of Horses Undergoing a Glucocorticoid Challenge. Proceedings ASAS, 2017.
[3] Vetvicka, V. and Vetvicka, J. (2007). "An Evaluation of the Immunological Activities of Commercially Available β1, 3-Glucans." JANA 10(1): 25-31.

injection further validating the immune suppression model of glucocorticoid injection (Figure 1). Horses receiving beta glucan regardless of concentration displayed an increase in $CD8^+$ T cells at 8 hours post glucocorticoid administration ($P<0.0001$; Figure 2). Horses in the LOW group displayed an increase in MO LFA-1 at 8 hours post challenge compared to CON and HIGH groups ($P=0.0006$; Figure 3). Horses in the HIGH group had an increase in LO LFA-1 at 24 hours compared to the CON group ($P=0.0868$; Figure 4).

< IMPLICATIONS >

These data demonstrate a potential beneficial effect of beta glucan supplementation on immune function in the horse. $CD8^+$ T cells are white blood cells that are cytotoxic and responsible for killing infected cells, eliminating viruses and intracellular bacteria. An increase in this cell type could allow a horse to better respond to an infection or immune challenge. Monocytes and lymphocytes are white blood cells that together function to recognize pathogens and activate a proper immune response. LFA-1 is a critical cell membrane associated molecule that allows cells to move through tissues and promotes cellular interaction. The increased LFA-1 expression observed on the monocytes and lymphocytes in beta glucan supplemented horses supports an activated immune system as compared to the non-supplemented group. Taken together, these data indicate that the immune challenge was successful in suppressing the immune system and beta glucan supplementation modulated the immune system during challenge.

FIGURE 1 — CONTROL — LOW — MID — HIGH

Cortisol response to glucocorticoid administration. (Times indicated as: PRE=baseline, 15 days prior to glucocorticoid testing; Time 0=pre-injection; 8 hours post injection; 24 hours post injection; 48 hours post injection). *Differing superscripts indicate significance at P < 0.05.*

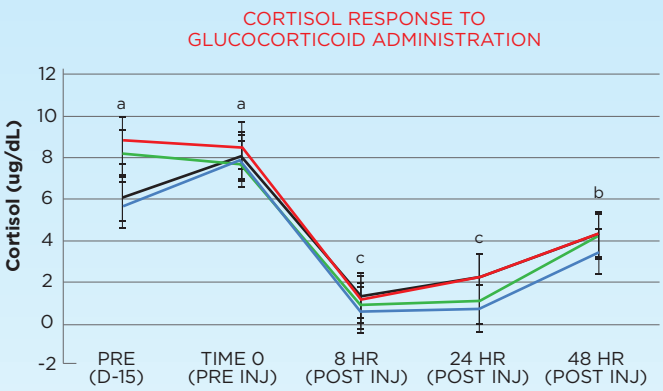


FIGURE 2 — CONTROL — LOW — MID — HIGH

$CD8^+$ T cell number in horses prior to and following a glucocorticoid challenge (Times indicated as: PRE=baseline, 15 days prior to glucocorticoid testing; Time 0=pre-injection; 8 hours post injection; 24 hours post injection; 48 hours post injection). *Differing superscripts indicate significance at P < 0.05.*

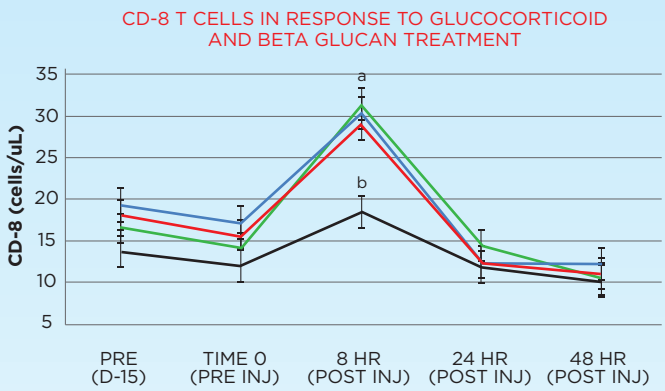


FIGURE 3 — CONTROL — LOW — MID — HIGH

Monocyte LFA-1 expression in horses prior to and following a glucocorticoid challenge. (Times indicated as: PRE=baseline, 15 days prior to glucocorticoid testing; Time 0=pre-injection; 8 hours post injection; 24 hours post injection; 48 hours post injection). *Differing superscripts indicate significance at P < 0.05.*

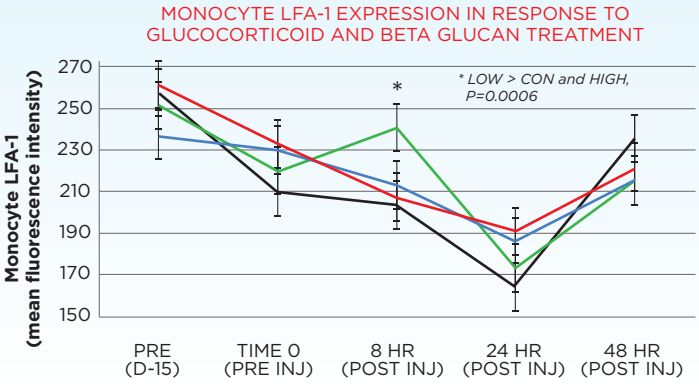
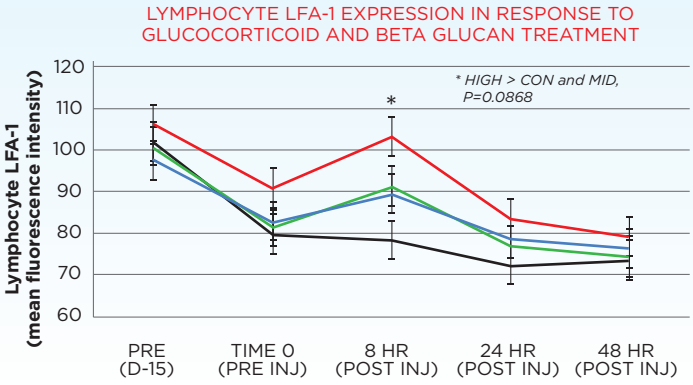


FIGURE 4 — CONTROL — LOW — MID — HIGH

Lymphocyte LFA-1 expression in horses prior to and following a glucocorticoid challenge. (Times indicated as: PRE=baseline, 15 days prior to glucocorticoid testing; Time 0=pre-injection; 8 hours post injection; 24 hours post injection; 48 hours post injection). *Differing superscripts indicate significance at P < 0.05.*



< AVAILABLE UPON REQUEST > Contact your local Purina representative if you would like more information about these studies.

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