Bacterial Lipopolysaccharide and Dietary Natural Source Vitamin E Effects on Broiler Chick Immune Response

A.S. Leaflet R2480

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Summary and Implications

Effect of lipopolysaccharide (LPS) injection and dietary natural source vitamin E (NSVE) levels on RNA expression levels of 14 immune related genes were measured in peripheral blood lymphocytes of broiler. Broilers immunologically responded to injection of LPS (bacterial membrane component) with a pro-inflammatory response of interleukin 6 (IL6) and an innate response of avian beta-defensin 10 (AvBD10) and inducible nitric oxide synthase (iNOS). The genes profiled in this study did not differed only moderately in RNA expression level between the NSVE dietary levels. This study confirmed and expanded our understanding of the network of genes involved in chicken's immune response to bacterial infection. Newly described AvBD10 RNA expressed in LPS-injected birds emphasizes the importance of innate immunity in defense against bacterial infection.

Introduction

Broiler chickens are exposed to a wide range of pathogens, including viruses, bacteria and parasites. Infections may reduce growth and performance. The host fights infections through both broad-spectrum (unnate) and highly-specialized (adaptive) immunity. Injection of LPS (a chemical isolated from bacteria) is a model of bacterial infection, which allows study of the inflammatory response without infecting birds with live bacteria. Dietary vitamin E modulates immune function and growth in broilers. We hypothesized that high levels of natural source vitamin E (NSVE) would enhance immune response to bacterial infection while helping to maintain growth performance. The objectives of the current study were to (1) expand knowledge of the inflammatory response to LPS in broilers and (2) evaluate the role of dietary NVSE levels on immune response after broilers were injected with LPS.

Materials and Methods

Day old commercial broilers (n =24) were placed on one of two diets that differed in amount of supplemental vitamin E. Until 23 days of age, broilers were fed diets of either industry standard or enhanced (10X standard) levels of NSVE. At 23 days of age, chickens were subcutaneously injected with LPS (100 ug/kg body weight) or saline. Three hours post injection (PI), blood was collected, and then peripheral blood mononuclear cells were isolated for subsequent RNA isolation. Levels of RNA expression for 14 immune related genes were measured by quantitative PCR. Effect of LPS injection and dietary levels of NSVE on immune gene expression levels were statistically determined.

Results and Discussion

Regardless of diet, LPS injection resulted in significantly higher AvBD10, interleukin 6 (IL6), and inducible nitric oxide synthase (iNOS) RNA expression levels (Table 1, Figure 1). Increased expression of the pro-inflammatory gene IL6 is indicative of inflammatory response induction to LPS injection. Both AvBD10 and iNOS are part of the innate immune response and, thus, their up-regulation illustrates the importance of innate immunity in defense against a bacterial infection. Diet effects on gene expression were moderate ($0.05 < p < 0.10$) for AvBD10, IFN-γ, and TGF-β4.

Acknowledgements

This work was done in collaboration with S. S. Block and M. Sifri of Archer Daniels Midland.

Figure 1. Fold change ($2^{LPS-saline}$) in immune response gene expression level from peripheral blood mononuclear cell 3 h after injection of LPS.

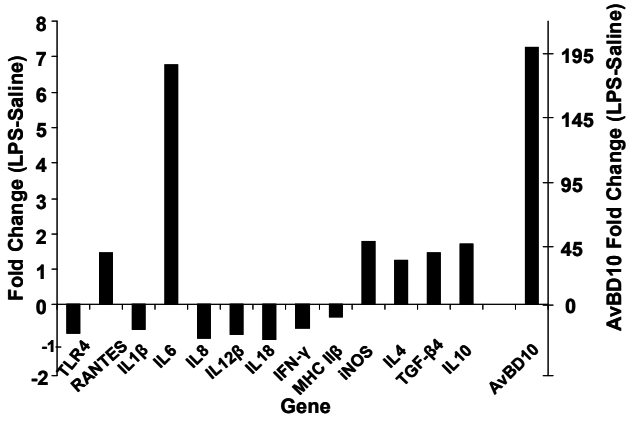

Table 1. Effect of LPS injection and dietary vitamin E level on immune gene expression in peripheral blood mononuclear cells isolated from broilers (*P* value).

	Source of Variation	
Gene	LPS	Vitamin E Level
TLR4	0.58	0.95
AvBD10	**0.00**	**0.08**
RANTES	0.48	0.24
IL1β	0.25	0.61
IL6	**0.01**	0.90
IL8	0.92	0.90
IL12β	0.74	0.16
IL18	0.95	0.82
IFN-γ	0.17	**0.07**
MHC IIβ	**0.05**	0.34
iNOS	**0.00**	0.47
IL4	0.52	0.22
TGF-β4	0.37	**0.09**
IL10	0.22	0.91