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PROCILLUS™

POULTRY RESEARCH BULLETIN 18

Procillus™ improves gut barrier function and reduces inflammatory cytokines in vitro

INTRODUCTION

Procillus' two novel *Bacillus velezensis* (BV) strains were selected for their ability to **improve gut barrier function** and promote a **balanced immune system**, as well as **reduce pathogenic challenges** in poultry. In Procillus, these novel BV strains have been combined with complex carbohydrates and metabolites from *Saccharomyces cerevisiae* which have a well-documented effect on reducing *Salmonella* and *E. coli* levels in poultry.

A balanced and well-regulated immune system is critical for bird health and performance. Intestinal stressors from the environment such as lipopolysaccharide (LPS) stimulate production of proinflammatory cytokines like TNF-α, MIP-2, and IL-6, which if left unchecked, can lead to leaky gut, systemic inflammation, and reduced bird performance. Research with intestinal IEC-6 cells demonstrates that the *Bacillus* strains in Procillus help promote a balanced immune system by reducing expression of proinflammatory cytokines and improving gut barrier integrity as measured by transepithelial electrical resistance (TEER).

Importantly, the poultry gut is colonized by a complex community of microbes known as the **gut microbiome**. The gut microbiome is a critical factor for gut health as it influences whether the gut is in an inflammatory or balanced state. Flocks in each production system possess a unique gut microbiome, so it is important to assess how feed additives modify gut health within each production system. Natural Biologics, in partnership with BioActive Innovations and Navitro Biosciences, has developed a laboratory assessment tool to test the microbiome health of your flocks and to determine how Procillus can help.

METHODS

- In Experiment 1, TEER was used to measure gut tissue barrier integrity. Epithelial cells (IE6-C; ATCC), under a LPS challenge, were co-incubated with novel BV strains for 24 hours. Then, TEER was performed to measure barrier function for the four treatments (Table 1).
- In Experiment 2, IEC-6 cells were co-incubated with LPS and novel BV strains for one hour. The inflammatory cytokines (TNF-α, MIP-2, and IL-6) were then measured for the four treatments (Table 1).

Table 1. Treatments

Treatment	*B. velezensis*	LPS challenge
Control	No	No
LPS	No	Yes
BV 1.1	Yes	Yes
BV 17	Yes	Yes

RESULTS

- In Experiment 1, TEER was similar for the control, BV 1.1, and BV 17 (Figure 1). Both BV strains decreased permeability of the gut epithelial cells as measured by increased TEER.
- In Experiment 2, compared to the LPS challenged cells, both BV strains significantly decreased the inflammatory cytokines (TNF- α, MIP-2, and IL-6; Figure 2).

Figure 1. The effect of novel *Bacillus velezensis* (BV) on transepithelial electrical resistance (TEER).

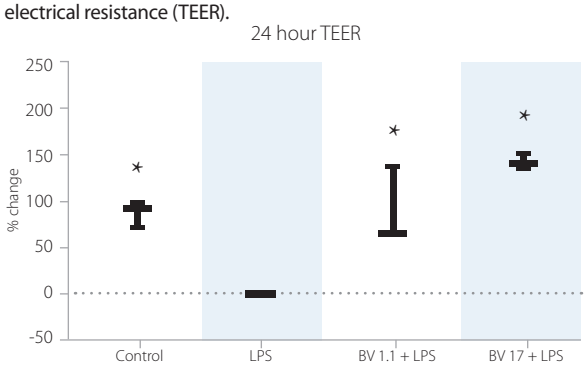
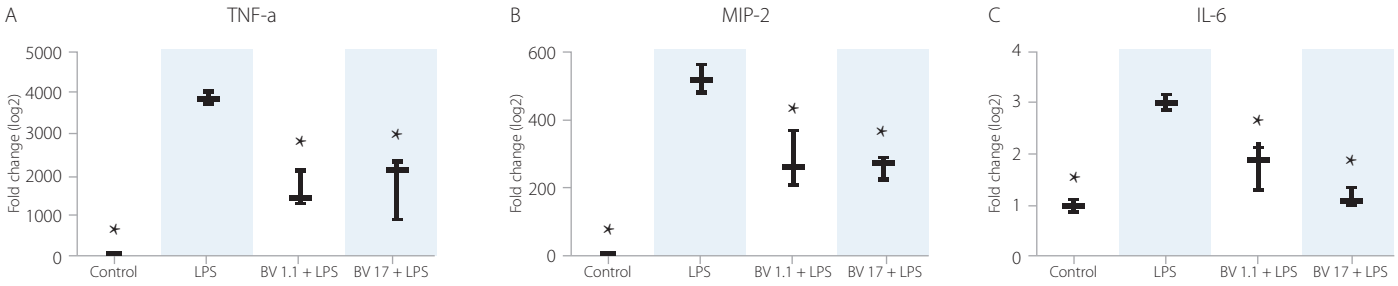


Figure 2. Novel *Bacillus velezensis* (BV) strains reduce inflammatory cytokines



IMPLICATIONS

In vitro, Procillus™ improved gut barrier cell integrity and reduced inflammatory cytokines in response to an LPS challenge. Procillus can be fed to all phases and types of poultry to improve resilience and health by helping to prevent leaky gut and reduce the expression of inflammatory cytokines.

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