# Natural Antibiotic Alternatives to Boost Animal Immunity and Disease Resistance

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## Introduction

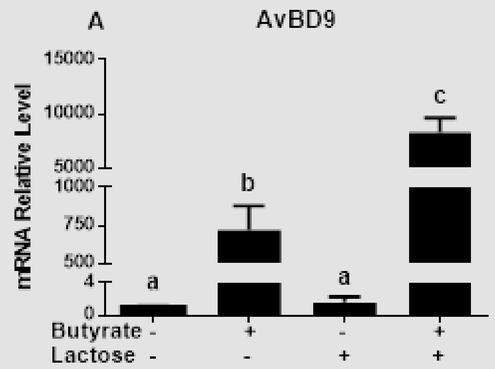
Antibiotics have been used in the feed of livestock and poultry for growth promotion and disease prevention for many decades; however, in recent years, there has been an outcry for elimination of antibiotics in order to reduce the emergence of drug-resistant bacteria. The Food and Drug Administration (FDA) has implemented a new guideline to phase out the use of medically important antibiotics in poultry, cattle, and swine as of January 2017. Therefore, new antibiotic alternative strategies are needed to ensure animal health and productivity. Modulating the synthesis of endogenous host defense peptides (HDPs) is being explored as a novel antibiotic-alternative approach to disease control and prevention.

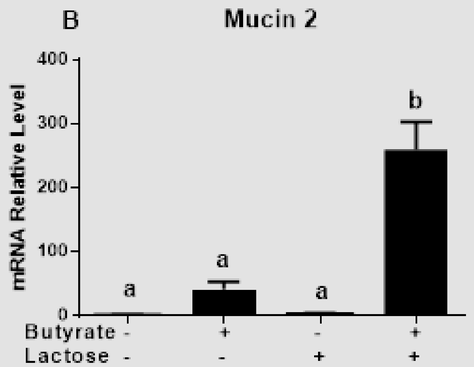
My research is focused on the evaluation of two natural dietary compounds, named butyrate and lactose. My hypothesis is that when butyrate and lactose are used together, they will have a synergy in enhancing chicken HDP synthesis and barrier function far greater than when each compound is used individually. The goal of my research is to develop the combination of butyrate and lactose as an alternative to antibiotics for use in the livestock and poultry industries.

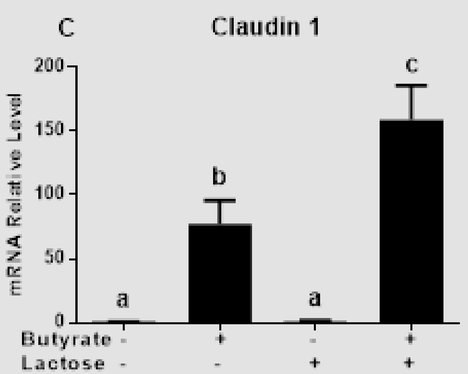

## Methodology

- A chicken macrophage cell line (HD11) is cultured in a complete RPMI medium.
- HD11 cells are seeded in 12-well plates overnight before they are stimulated with 2 mM sodium butyrate and 0.1 M lactose individually or in combination for 24 hours. An unstimulated control is also included.
- The stimulated HD11 cells are harvested for isolation of total RNA using RNAzol RT (Molecular Research Center, Cincinnati, OH) and the RNA concentrations are quantified using Nanodrop 1000 Spectrophotometer (Thermo Fisher Scientific, Waltham, MA).
- Total RNA is then reverse transcribed in order to synthesize complementary DNA (cDNA) using an iScript cDNA Synthesis Kit (Bio-Rad Laboratories, Hercules, CA).
- Quantitative polymerase chain reaction (qPCR) is then performed to analyze the expression levels of the chicken HDP gene (AvBD9) and the two barrier function genes (mucin 2 and claudin 1).
- The results presented were means ± the standard errors of the mean (SEM) of the three independent experiments.
- One-way analysis of variance (ANOVA) is used to determine whether there is any statistically significant differences among different treatments.
- When significance is detected, a post-hoc Tukey test was performed to reveal statistical significance among different pairs of the treatments.
- Treatments with different superscripts means statistical significance ($P < 0.05$).

## Results




## Discussion

- The results clearly indicate that butyrate synergizes with lactose to enhance the expressions of AvBD9 and the barrier function genes in chicken HD11 cells at the highest levels.
- The results suggest that there is a beneficial role of using a combination of butyrate and lactose in enhancing gut health and possibly animal performance.

## Conclusion

- The experimental results was found to support my hypothesis. The combination of the two compounds working together induced the highest expressions of the HDP and barrier functions genes.
- The outcome of this research will help pave the way for the development of natural antibiotic alternatives to boost animal immunity and disease resistance for livestock and poultry use.

## Acknowledgements

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