The effect of yeast cell wall preparations on salmonella colonisation, gastrointestinal health and performance of broiler chickens

by

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I, Mieke Brümmer, declare that this dissertation for the degree M.Sc. (Agric) at the University of Pretoria has not been submitted by me for a degree at any other university.

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Abstract

The main aim of the studies was to evaluate the modes of actions of Bio-Mos and the effect that it has on intestinal health as well as performance in broiler chickens. For the purpose of this study there were 2 main objectives. The first was to determine the effect of Bio-Mos as well as soluble mannan on salmonella colonization and to do this it was necessary to develop an *in vivo* pathogen challenge model, specifically designed for salmonella, using the chicken as animal model. The aim with this salmonella assay was to design a model that could accurately determine the efficacy of different components of the yeast cell wall at reducing or eliminating salmonella colonisation in chickens. The second objective was to evaluate the effect of Bio-Mos with or without the addition of a soluble mannan, fed at different inclusion levels, on chicken health. Specific parameters measured included feed conversion ratios (FCR), volatile fatty acid (VFA) analysis, antibiotic resistance amongst coliform populations, immunoglobulin quantification and gut morphology. Gut morphology measurements included villi height and width, crypt depth, muscularis thickness, goblet cell size and goblet cell density.

The salmonella assay trial was not able to yield positive results for either the cell wall preparations or the positive control, indicating that there are some external factors that have to be addressed before this assay can be used to draw any accurate conclusions from. The second section of this study did show FCR differences between some of the treatments, but did not show numerically large differences for VFA production or antibiotic resistance, however the histological evaluation did yield interesting results. Measurements based on the villi height and width, crypt depth and muscularis thickness showed no significant differences between treatments but there was a treatment effect on the goblet cells. The goblet cells of chickens receiving cell wall preparations were statistically significantly larger and present at a higher density than those of the control treatment birds.

In an attempt to develop the salmonella assay several aspects of the existing assay model were altered or eliminated. It is possible that the assay can work with some more

adjustments, but due to time constrictions it was not possible to further explore alternative approaches. Little research has been done on the effect of nutrition on the goblet cells in chicken intestines. The results noted in this report warrant a more in-depth investigation into the exact modes of action resulting in the differences in goblet cells observed. The use of cell wall preparations on a commercial level holds many advantages, as cell wall preparations appear to affect animal health in a positive way.

Frequently used abbreviations

MOS: Mannan oligosaccharide

MRF: Mannan rich fraction

H & E stain: Hematoxylin and Eosin stain

AB/PAS: Alcian Blue and Periodic Acid Schiffs stain

FCR: Feed conversion ratio

VFA: Volatile fatty acid

CFU: Colony forming unit

CE: Competitive exclusion

FCC: Fresh caecal culture

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