Vitafibra, a unique health fiber, as a successful part of zinc oxide replacement

De Vos M., D'Inca R., Lannoo K., Vande Ginste J.
Nuscience, Drongen, Belgium

Background and objectives

Enterotoxigenic *E. coli* F4 is associated with post-weaning diarrhea in piglets. The initial step of an *E. coli* infection is to adhere to host-specific receptors present on the enterocytes and thereby immune responses are initiated[1]. The aim of this study was to investigate the potential of a health fiber (Vitafibra) on the prevention of adhesion by agglutination of *E. coli* and active blocking of the immune receptors.

Material and methods

To study the binding capacity of Vitafibra, *E. coli* F4 strains were mixed into a 100 ml solution together with 0.2 g of Vitafibra (except for the negative control). *E coli* strains were allowed to adhere to Vitafibra. Afterwards, samples were filtrated (4-7 µm Whatmann) and filtrates were plated to check the amount of *E. coli* that could be recovered. In addition, the remaining residue was cultured to check how much of the residual *E. coli* was still able to grow. The amount of culturable *E. coli* was determined on the start culture, on the filtrate and on the residue by classical laboratory methods.

In order to study the blocking capacity of Vitafibra, the HEK-Blue cell culture assay was used (InvivoGen, Toulouse, France). These cells are known to express soluble embryonic alkaline phosphatase (SEAP) in response to stimulation of the NF-κB receptor. Cells were treated with LPS to stimulate SEAP expression and in the test group 1 mg/ml Vitafibra was administrated. The produced SEAP is secreted in the culture media and is quantified by measuring colorimetric changes after the addition of Quanti-blue reagent.

Results

The addition of Vitafibra to the bacterial strain results in a strong reduction of *E. coli* in the filtrate. Only 1% of *E. coli* passes through the filter, the remainder (99%) was found in the residue and thus considered to be captured by Vitafibra. To show *E.coli* was disactivated, a cultivation method was performed on the residue. This method showed that only 21% of the original *E. coli* could still be cultivated, meaning that 78% was bound and prohibited to grow.

When HEK-Blue cells were exposed to LPS, these cells secreted SEAP. However, the addition of Vitafibra resulted in a decrease of activation of NF-κB (1.7 ± 0.8 fold-change compared to negative control medium) compared to the control group without Vitafibra (13.1 ± 1.7 fold change).

Conclusion and discussion

Vitafibra has the ability to capture 99% of *E. coli* in an in vitro suspension. Moreover, the major part of this *E. coli* was unable to be cultivated after the agglutination process. Additionally, based on an *in vitro* assay, it was demonstrated that Vitafibra is an effective blocker of the immune receptor as a strong reduction in SEAP was shown.

To conclude, Vitafibra reduces the risk of pathogen overgrowth by capturing *E. coli* bacteria and by blocking immune receptors, resulting in less stimulation of inflammation. This makes Vitafibra a successful feed additive in the battle against *E.coli* diarrhea.

References

[1] The F4 fimbrial antigen of *Escherichia coli* and its receptors, W. Van den Broeck, E. Cox, B. Oudega, B.M. Goddeeris, Veterinary Microbiology 71 (2000) 223-244