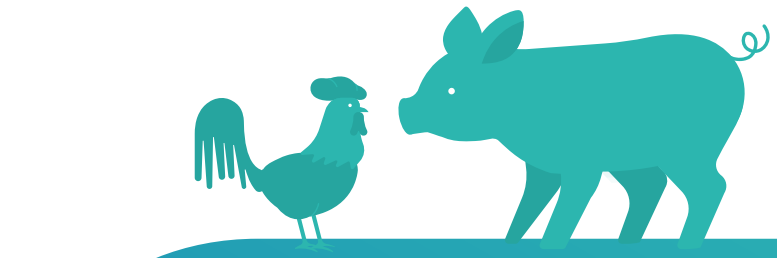
CJ BIO



GutLuk

Gut Health Solution of
a Natural AGP Alternative

GutLuk

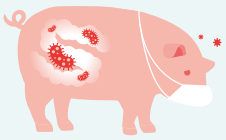
GutLuk

GutLuk is a natural AGP alternative that regulates intestinal microbiota through inhibition of bile salt hydrolase (BSH).

Background and History: 'Antibiotics and BSH Inhibitors'

- Enteric diseases are mostly caused by overgrowth of intestinal pathogens, leading to reduced productivity.
- Antibiotic growth promoters (AGPs) have been used to control the overgrowth of enteric pathogens.
- While searching for AGP alternatives, researchers noticed that the use of AGPs significantly reduce bile salt hydrolase (BSH) activity that is protecting pathogens from bactericidal activity of bile salt (BS).
- GutLuk is a natural product inhibiting BSH activity and hence effectively replaces AGPs and feed additives targeting intestinal pathogens.

Commercial Issue



Most of enteric diseases are caused by pathogenic bacterial overgrowth

Prophylactic AGPs

Controlling pathogen overgrowth with AGPs (antibiotics, ZnO, Cu)

Discovery

Researchers noticed that AGPs reduce bile salt hydrolase activity in the gut

Development

Natural source of BSH Inhibitor as an AGP alternative has been developed by CJ BIO

Product Development Process: AI Machine Learning Technology

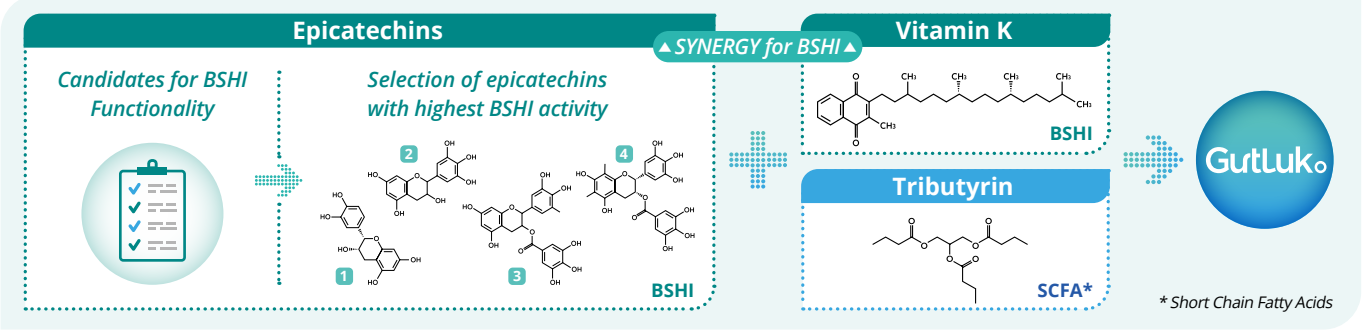
STEP 1 Screened key ingredients with 'BSHI Functionality' using big data analysis assisted by artificial intelligence (AI) technology

STEP 2 Candidate ingredients were tested for BSHI capacity through in-vitro test

STEP 3 Designing an optimal blend and dose through in vitro, ex vivo evaluations and in vivo validation

Combination of GutLuk

- The optimal combination of 'Epicatechins + Vitamin K + Tributyrin' for controlling of pathogen overgrowth.
- Among the various types of epicatechins (EC) in nature, CJ BIO screened and selected a group of EC that has best BSHI functionality after years of research.
- Moreover, CJ BIO found the best combination (the EC group and Vit K) that synergistically enhance BSHI functionality.

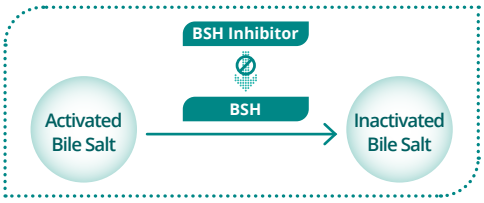


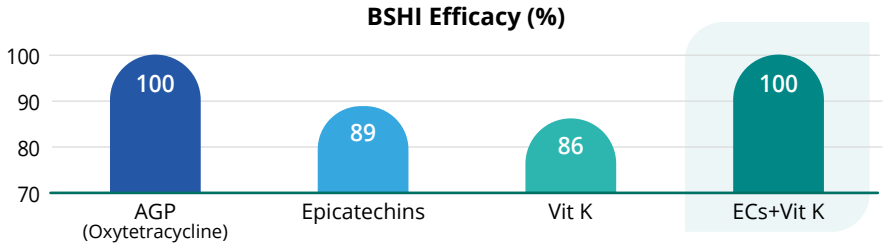
GutLuk (In vitro)

Product Verification: In vitro

BSHI Efficacy of AGP and Components of GutLuk

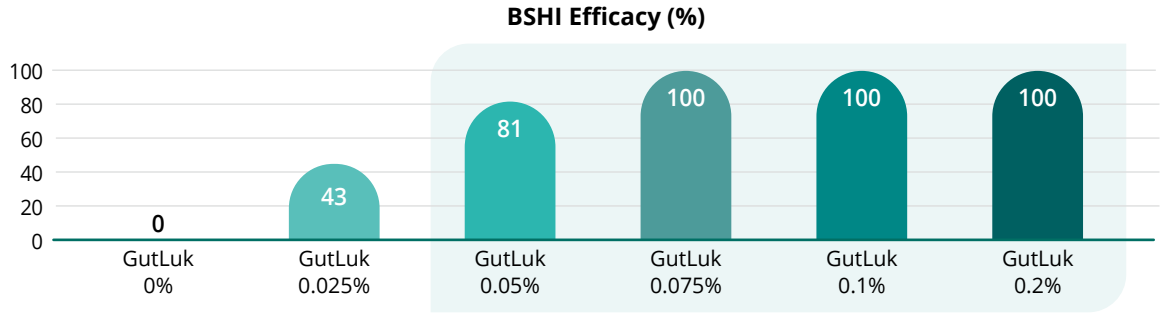
- How to measure BSHI Efficacy?
  : Measuring the amount of activated bile salts
  : BSHI prevents the conversion of activated BS to inactivated BS by BSH
- Surprisingly, combining both the selected epicatechins and Vit K at certain inclusion level showed a comparable level of BSHI Efficacy rate to AGP





BSHI Efficacy by Recommended Dosage of GutLuk

- BSHI Efficacy (%) by GutLuk's recommended dosage (0.05% – 0.2 % in feed)



Mode of Action : BSH Inhibitors and SCFA

MOA: Bile Salt Hydrolase Inhibitors

Bile Salt (BS)

- Controls pathogen overgrowth by destructing cell walls
- Boosts lipid digestion

Bile Salt Hydrolase (BSH)

- Enzymes that hydrolase BS
- Produced by bacteria as a defensive mechanism to survive against BS

BSH Inhibitor (BSHI)

- BSHI inhibits the action of BSH
  → maintains the level of BS
  → controls pathogens and helps lipid digestion

MOA: Short Chain Fatty Acids

Control of Gut Environment

- Reduces pathogen overgrowth and boosts the growth of beneficial bacteria
- Maintains intestinal integrity
- Speeds up recovery of damaged epithelial tissue

Immune Regulation

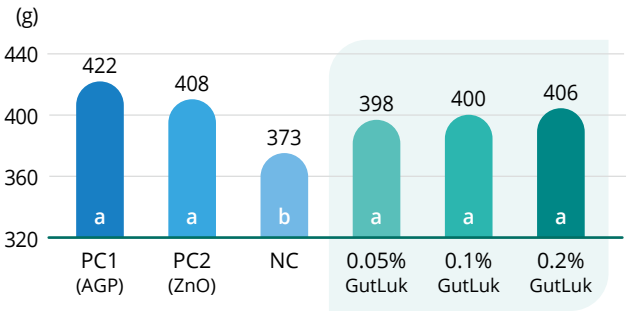
- Reduces inflammatory cytokines of TNF-α and IL-6
- Increases IgA to boost immune response

GutLuk (In vivo)

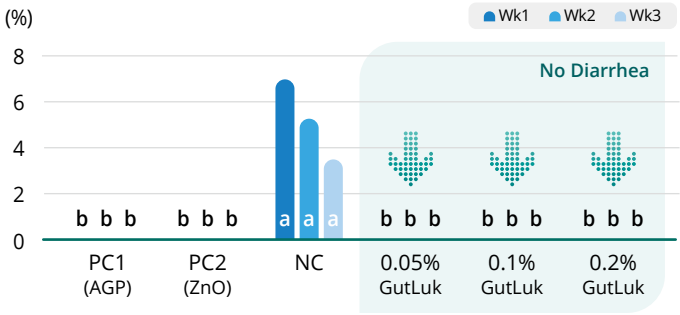
Product Verification: In vivo

TRIAL 1 GutLuk Significantly Improves Both Growth Performance and Gut Health as Indicated by Diarrhea and Composition of Mucosa-Bound Microbiota in Piglets

ADG



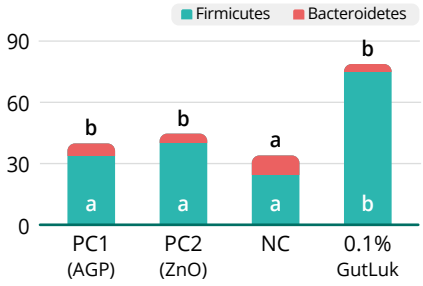
Diarrhea



Microbiota (Gut Mucosa)

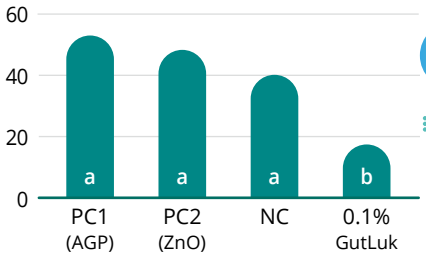
Phylum Level

Firmicutes: Bacteroidetes (F:B)



* Increased F:B ratio is positive for weight gain

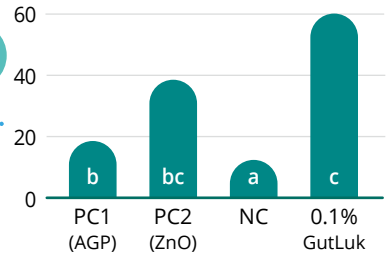
Proteobacteria



* Major pathogens belongs to proteobacteria phylum

Genus Level

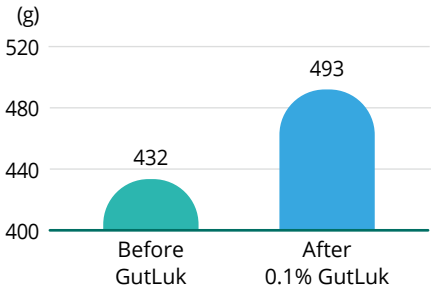
Lactobacillus



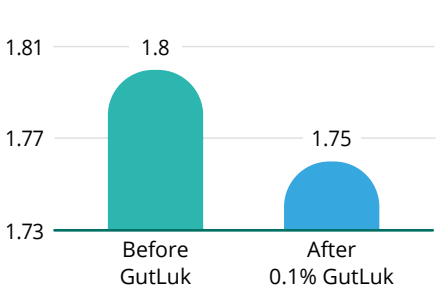
TRIAL 2 GutLuk Remarkably Improves Both Growth Performance and Mortality in the Commercial Farm in Piglets

- The data below was tracked for over three months before and after 0.1% GutLuk supplementation.

ADG



FCR



Mortality