Science Review:
Integrative Approaches to General Wellness and Gut Health: Prebiotics, Probiotics, and Postbiotics

The increasing prevalence of metabolic and gastrointestinal disorders has spurred the scientific community to investigate dietary interventions that function synergistically to holistically improve human health. The gut microbiota is pivotal to health, impacting everything from metabolic functions to the immune system. Current research underscores the interconnected roles of prebiotics, probiotics, and postbiotics in regulating the gut environment.

This represents a breakthrough in science by combining the probiotic *Bifidobacterium lactis* 420, the postbiotic *Akkermansia muciniphila* Muc^{T}, along with prebiotic Inulin. Each component is supported by extensive research demonstrating their efficacy in enhancing gut health and metabolic processes.

Research Highlights

- ✓ Inulin boosts gut B420 levels, improves stool frequency and consistency, and provides additional benefits such as increased fiber intake, decreased gas retention, and potential anti-inflammatory effects.
- ✓ Research confirms B420's effectiveness in reducing body and fat mass in overweight adults while modulating metabolic health markers, including decreasing plasma LPS levels, liver inflammation, and E. coli adhesion in diabetic models. B420 also enhances gut microbiota health by increasing *Akkermansia muciniphila* abundance and elevating GLP-1 levels, which promotes satiety and boosts SCFA production.
- ✓ *Akkermansia muciniphila* enhances gut barrier integrity and metabolic health by utilizing mucins and producing SCFAs. Its protein Amuc_1100, activates TLR2 signaling to improve insulin sensitivity and reduce body fat. Clinical trials have shown that **pasteurized** forms exhibit enhanced efficacy in improving metabolic parameters, significantly reducing weight, cholesterol levels, and inflammatory markers.

Inulin: A Prebiotic Fiber Enhancing Beneficial Gut Microbiota Growth

Prebiotics, primarily fermentable soluble fibers, facilitate the proliferation of beneficial gut microbiota. Sources such as apples, asparagus, and Jerusalem artichokes are rich in these fibers. Furthermore, specific supplementation with prebiotics like chicory root can augment gut health by more effectively promoting the growth of beneficial bacterial colonies. This targeted supplementation strategy can be particularly beneficial for enhancing gastrointestinal function and optimizing microbial balance in the gut.

MOA: Chicory root, rich in inulin-type fructans, resists digestion by gastrointestinal enzymes, allowing them to reach the colon intact to nourish resident microbiota. The fermentation of these fructans produces short-chain fatty acids (SCFA) and other metabolites that lower colon pH, inhibit pathogen growth, and significantly enhance gut integrity by improving mucosal barrier functions, immune modulation, and mineral absorption.[1,2] Chicory root supplementation has been shown to enhance gut microbiota by increasing *Bifidobacterium* populations, as evidenced by a 2022 meta-analysis which found significant microbial augmentation at daily doses of three grams.[3] Further studies confirm additional benefits of chicory supplementation, including enhanced fiber intake, decreased gas retention, constipation relief, and potential anti-inflammatory effects.

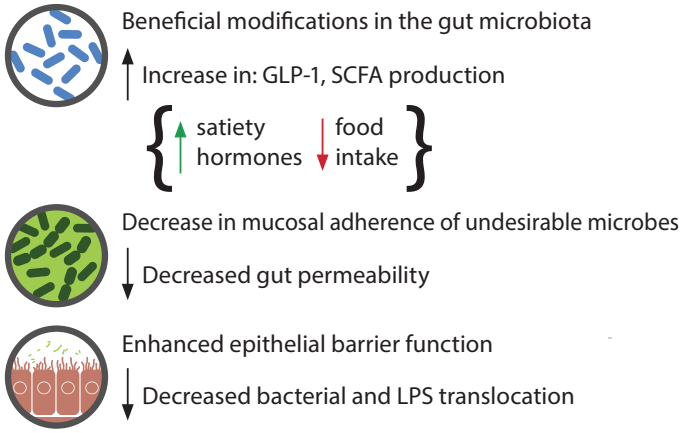
Scientific Basis for *Bifidobacterium lactis* 420 in Managing weight and Gut Health

B420 has undergone extensive clinical evaluation, demonstrating significant benefits in managing body weight and enhancing gut barrier integrity. In a pivotal study with 225 overweight and obese adults, supplementation with B420, particularly when used in conjunction with a dietary fiber supplement, resulted in a significant decrease in body fat mass by 1.4 kg and waist circumference by 2.4 cm, compared to placebo.[4] This probiotic has also been shown to lower plasma lipopolysaccharide (LPS) levels, which are linked to systemic inflammation and metabolic endotoxemia, thereby improving liver inflammation markers and reducing the adhesion of pathogenic bacteria like E. coli in the distal gut.[5] Additionally, it has been shown that after six months of consuming B420 (both with and without fiber), compared to placebo, there was a notable increase in the gut microbiota's abundance of *Akkermansia muciniphila*.[6]

Further research has highlighted B420's role in increasing the secretion of glucagon-like peptide 1 (GLP-1), a satiety-enhancing gut peptide, via the microbial production of SCFAs such as butyrate from intestinal L-cells.[7,8]

MOA: B420 exerts its effects through several mechanisms within the gut environment and intestinal barrier. It promotes beneficial changes in the gut microbiota that enhance the production of GLP-1 and SCFAs. This increase contributes to heightened secretion of satiety hormones, leading to reduced food intake. The probiotic also decreases the mucosal adherence of undesirable microbes and lowers gut permeability. Together, these actions improve epithelial barrier function and reduce the translocation of bacteria and LPS, thereby stabilizing gut integrity and potentially mitigating systemic inflammation and metabolic endotoxemia.[4-8]

B. lactis 420 potential mechanisms of action[1,2,4-7]



Metagenics Institute

Role of *Akkermansia muciniphila* in Promoting Gut Barrier Function and Metabolic Health

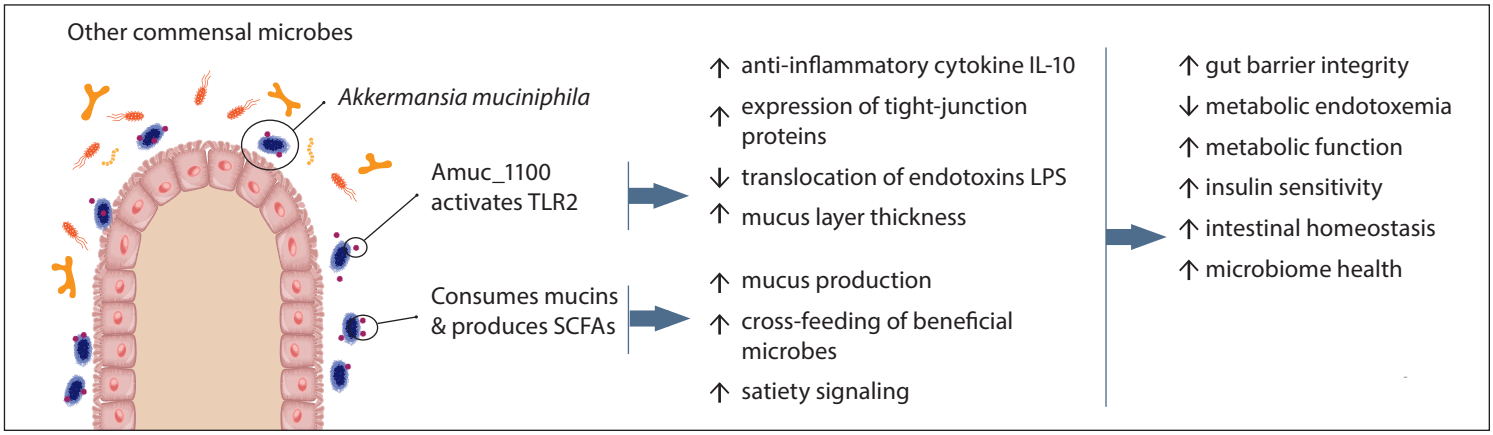
The gut mucus layer serves as a critical defense barrier, essential for the intestinal health of the host.[9] *Akkermansia muciniphila*, unlike many of the known probiotic species, is a unique commensal microbe inhabiting the mucus layer, interacting with intestinal epithelial and immune cells. It utilizes mucins as nutrients to produce beneficial SCFAs, enhancing the gut barrier and supporting metabolic health.[10,11] Enhanced levels of *Akkermansia muciniphila* correlate with improved metabolic indicators, such as increased insulin sensitivity and reduced body fat.[10]

In a randomized, double-blind, placebo-controlled trial, 32 overweight or insulin-resistant individuals received placebo, live *Akkermansia muciniphila* (10 billion CFU/day), or pasteurized *Akkermansia muciniphila* (30 billion TFU/day) for three months. The pasteurized form significantly improved insulin sensitivity, reduced insulinemia, plasma cholesterol levels, body weight, and waist circumferences, and also decreased plasma LPS levels by 117%, suggesting a reduction in metabolic endotoxemia and improvement in gut barrier function.[12] Pasteurized form was also found to reduce dipeptidyl peptidase-IV (DPP-IV) activity, further modulating inflammation. DPP-IV plays a role in modulating inflammation by interacting with immune system components, such as cytokines, and influencing the immune response and inflammatory processes. Both forms were found to be safe and well-tolerated.[12]

MOA: *Akkermansia muciniphila* addresses metabolic disturbances from high-fat diets by upregulating mucin production, strengthening intestinal barrier integrity, and activating anti-inflammatory pathways via its membrane protein, Amuc_1100's, interaction with Toll-like receptor 2 (TLR2). Pasteurization appears to enhance the efficacy of *Akkermansia muciniphila* by stabilizing the heat-stable Amuc_1100, thereby boosting its therapeutic effects on gut integrity and metabolic health.[13,14] Pasteurization enhances the expression of tight junction proteins, such as Occludin and Claudin, which reduces cellular permeability, thereby diminishing LPS translocation and inflammation, ultimately supporting gut barrier integrity.[13]

Summary: Combined Impact of B420, *Akkermansia muciniphila*, and Inulin

The combination of B420, *Akkermansia muciniphila*, and Inulin leverages their synergistic effects to enhance gut microbiota diversity and function. This blend of prebiotic, probiotic, and postbiotic components is designed to support a robust immune response, improve metabolic health, and maintain a healthy gut barrier, which are integral to overall health and well-being.



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