

Recent Studies and Publications on Prebiotics and Health Effects

STUDIES

1. Prebiotic And Immunomodulatory Properties Of The Microalga *Chlorella Vulgaris* And Its Synergistic Triglyceride-Lowering Effect With Bifidobacteria

Study results demonstrate the prebiotic and immunomodulatory effect of the *Chlorella* powder and a synergic effect of *Chlorella* and *B. animalis* subsp. *lactis* BB-12 combination to decrease the level of triglycerides in the serum, liver, and heart of the treated rats. Consequently, the incorporation and/or combination of *Chlorella* together with bifidobacteria to functional food or fermented dairy products may have a positive effect on the viability of bifidobacteria and their properties, thus influencing human or animal health. Further, these results demonstrate that various combinations of *Chlorella* and bifidobacteria have significant potential for the development of new fermented products, dependent on the algal species, probiotic strain, application form, and concentrations for acceptable sensory quality for consumers.

Source: Ivana Hyrslova, Department Of Microbiology And Technology, Dairy Research Institute Ltd., 160 00 Prague, Czech Republic. Prebiotic And Immunomodulatory Properties Of The Microalga *Chlorella Vulgaris* And Its Synergistic Triglyceride-Lowering Effect With Bifidobacteria. *Journal Fermentation*, (2021), 7(3), 125. <https://doi.org/10.3390/fermentation70301255>

2. Anxiolytic Effects Of A Galacto-Oligosaccharides Prebiotic In Healthy Females (18–25 Years) With Corresponding Changes In Gut Bacterial Composition

This study examined the multiple indices of mood and well-being in 64 healthy females in a 4-week double blind; placebo controlled galacto-oligosaccharides (GOS) prebiotic supplement intervention and obtained stool samples at baseline and follow-up for gut microbiota sequencing and analyses.

The effects of the GOS intervention on self-reported high trait anxiety, attentional bias, and bacterial abundance, suggests that dietary supplementation with a GOS prebiotic may improve indices of pre-clinical anxiety. Further, research is required.

Source: Kathrin Cohen Kadosh, School Of Psychology, Faculty Of Health And Medical Sciences, University Of Surrey, Guildford, GU2 7XH, UK. Anxiolytic Effects Of A Galacto-Oligosaccharides Prebiotic In Healthy Females (18–25 Years) With Corresponding Changes In Gut Bacterial Composition. *Sci Rep* 11, 8302 (2021). <https://doi.org/10.1038/s41598-021-87865-w>

3. Cereal B-Glucan: A Promising Prebiotic Polysaccharide And Its Impact On The Gut Health

This systematic review shows the prophylactic and therapeutic role of cereal β -glucans on gut health in terms of its barrier permeability, modulation of gut microbiota, the intestinal immune system and intestinal inflammation, colon cancer protection and short-chain fatty acids production. Further, cereal β -glucans principally perform different biological actions through specific cytokines and hormones regulation.

Source: Mahtab Shoukat, Department Of Agricultural Sciences, University Of Naples 'Federico II', Via Università 100, Portici, Italy. Cereal B-Glucan: A Promising Prebiotic Polysaccharide And Its Impact On The Gut Health. *International Journal Of Food Science & Technology*, Volume 56, Issue 5, Special Issue: Microbiota, Probiotics And Prebiotics, May (2021), Pages 2088-2097. <https://doi.org/10.1111/ijfs.14971>

4. Lactose-Free Skim Milk And Prebiotics As Carrier Agents Of Bifidobacterium BB-12 Microencapsulation: Physicochemical Properties, Survival During Storage And In Vitro Gastrointestinal Condition Behaviour

In this present study the *Bifidobacterium BB-12* was microencapsulated by spray drying using lactose-free milk, lactose-free milk and inulin, and lactose-free milk and oligofructose, resulting in powders 1, 2 and 3, respectively. Researchers found highest encapsulation yield (88.01%) and the highest bifidobacteria viability during 120 days of storage for spray-dried powder 2. Spray-dried powders 1 and 3 show a higher tendency to yellow colour. After being submitted to in vitro-simulated gastrointestinal conditions, the best probiotic survival rate result was found for spray-dried powder 3 (87.59%). Therefore, *spray-dried powders containing prebiotics were the most appropriate combinations for microencapsulation of Bifidobacterium BB-12 and maintenance of cell viability during storage and gastrointestinal system, showing great potential to be used in lactose-free dairy products.*

Source: Elane Schwinden Prudencio, Department Of Food Science And Technology, Agricultural Sciences Center, Federal University Of Santa Catarina, Rod. Admar Gonzaga, 1346, Itacorubi, Florianópolis, SC, 88.034-001 Brazil. Lactose-Free Skim Milk And Prebiotics As Carrier Agents Of Bifidobacterium BB-12 Microencapsulation: Physicochemical Properties, Survival During Storage And In Vitro Gastrointestinal Condition Behaviour. *International Journal Of Food Science & Technology*, Volume 56, Issue 5, Special Issue: Microbiota, Probiotics And Prebiotics, May (2021), Pages 2132-2145. <https://doi.org/10.1111/ijfs.14823>

5. Innovative Production Of Multistrain Synbiotic Product Using Thai-Pigmented Rice And Rice Bran Oil

Scientists have found that the isolated probiotics *Lactobacillus paracasei* KUKPS6201, *L. acidophilus* KUKPS6107, *L. reuteri* KUKPS6103, *L. rhamnosus* KUKPS6007, *L. salivarius* KUKPS6202, *Bacillus coagulans* KPSTF02 and *Saccharomyces boulardii* KUKPS6005 had high potential for probiotic properties. All strains had antibacterial activity and high antioxidant activity of 1.654 ± 0.017 mg Trolox mL⁻¹ probiotic extract. The selected strains could survive in a simulated gastrointestinal tract under anaerobic conditions and shows no haemolytic activity. Further, the probiotic strains were strongly auto-aggregated and also showed co-aggregated ability with pathogenic bacteria. The probiotic microorganisms demonstrated high ability to adhere to Thai-pigmented rice grains. **The results of analysis of these probiotics shows that Riceberry rice bran oil was an excellent prebiotic.** A synbiotic product containing Thai-pigmented rice grains (cultivar Riceberry, Luem Pua and Black Jasmine) and rice bran oil was produced. After 8 weeks of storage, the viability of the probiotics in terms of multistrains was 7.36 ± 0.04 log CFU g⁻¹ (85.78% survival rate). Microbiological safety testing indicated that the amounts of contaminants were acceptable.

This study provided the first scientific report on the feasibility of applying Thai-pigment rice, rice bran oil and mixed-culture probiotics as a novel functional synbiotic product.

Source: Saran Promsai, Program Of Bioproducts Science, Department Of Science, Faculty Of Liberal Arts And Science And Division Of Microbiology, Department Of Science, Faculty Of Liberal Arts And Science, Kasetsart University, Kamphaeng Saen Campus, Nakhon Pathom, Thailand. Innovative Production Of Multistrain Synbiotic Product Using Thai-Pigmented Rice And Rice Bran Oil. International Journal Of Food Science & Technology, Volume 56, Issue 5, Special Issue: Microbiota, Probiotics And Prebiotics, May (2021), Pages 2182-2192. <https://doi.org/10.1111/ijfs.14973>

6. In Vitro Assessment Of Antimicrobial Efficacy Of The D-Tagatose And Lactobacilli-Based Synbiotic Preparations Against The Pathogenic Escherichia Coli And Salmonella Typhimurium

The study aimed to investigate the utilisation of *prebiotic D-tagatose* by *probiotic lactobacilli* (*L. rhamnosus* GG, *L. casei*, *L. acidophilus* and *L. fermentum*) and *enteric pathogens* (*E. coli* and *S. typhimurium*) to determine synbiotic potential of D-tagatose and lactobacilli combination. The antimicrobial efficacy of the synbiotic preparations (D-tagatose with lactobacillus) was assessed against selected pathogens in co-culture assays.

Scientists have found that D-tagatose supported growth of selected lactobacilli, especially the *L. rhamnosus* GG and *L. casei*, but not the enteric pathogens. The tested synbiotic preparations completely inhibited growth of both the pathogens, even in the presence of D-glucose in co-cultures. The well-diffusion assay demonstrated the presence of antimicrobial activity as recorded by drop of culture pH. The study substantiated that D-tagatose could be an effective prebiotic component for formulation of potential synbiotic combinations with *L. rhamnosus* GG or *L. casei* that can be used as an alternative to antibiotics against enteric pathogens.

Source: Ashis Kumar Samanta, ICAR-National Institute Of Animal Nutrition And Physiology, Adugodi, Hosur Road, Bengaluru, India. Synbiotic Preparations Against The Pathogenic Escherichia Coli And Salmonella Typhimurium. International Journal Of Food Science & Technology, Volume 56, Issue 5, Special Issue: Microbiota, Probiotics And Prebiotics, May (2021), Pages 2156-2165. <https://doi.org/10.1111/ijfs.149099>

7. Prebiotic Properties Of Xylooligosaccharide Extracted From Sugarcane Wastes (Pith And Rind): A Comparative Study

Xylooligosaccharide (XOS) was extracted from two sugarcane wastes (SW); rind (SR) and pith (SP), and the prebiotic properties of both XOS were examined.

This study shows that SR and SP had different mixture of XOS and were resistant towards α -amylase and gastric juice digestion in vitro. Although the growth of *Lactobacillus casei* Shirota (LcS) and *Bifidobacterium animalis* subsp. *Lactis* ATCC® 700541™ increased significantly in both XOS after 48 h of incubation, XOS from SR showed better enrichment of probiotics growth. Both XOS were found to be more fermentable by LcS and acetic acid was the predominant end product of the fermentation.

Source: Mohd Redzwan Sabran, Department Of Nutrition, Faculty Of Medicine And Health Sciences, Universiti Putra Malaysia, Serdang, Selangor, 43400 UPM Malaysia. Prebiotic Properties Of Xylooligosaccharide Extracted From Sugarcane Wastes (Pith And Rind): A Comparative Study. International Journal Of Food Science & Technology, Volume 56, Issue 5, Special Issue: Microbiota, Probiotics And Prebiotics, May (2021), Pages 2175-2181. <https://doi.org/10.1111/ijfs.14956>

8. Metabolism Of Wheat Dextrin, Partially Hydrolysed Guar Gum And Inulin By Bifidobacterium Lactis Or Lactobacillus Acidophilus In An In Vitro Gut Model Fermentation System

The aim of this study was to determine whether *wheat dextrin (WD)*, *partially hydrolysed guar gum (PHGG)* and *inulin or probiotics Lactobacillus acidophilus NCFM (NCFM)* and *Bifidobacterium lactis HN019 (HN019)* alone generate a more favorable gut bacterial community than when combined and also assessed the organic acid production following *prebiotics, probiotics* and *synbiotic* fermentation.

Study result shows that synbiotic inulin combined with either HN019 or NCFM may help to enhance bacterial metabolites and cross-feeding to lead to a prolonged elevation in *Bifidobacterium spp.*, and *lactic acid bacteria*.

Source: Dr. S. Pyle, Department Of Food And Nutritional Sciences, The University Of Reading, Whiteknights, Reading RG6 6DZ, United Kingdom. **Metabolism Of Wheat Dextrin, Partially Hydrolysed Guar Gum And Inulin By Bifidobacterium Lactis Or Lactobacillus Acidophilus In An In Vitro Gut Model Fermentation System. International Journal Of Probiotics And Prebiotics, Vol. 16, Pp. 22-30, (2021).** <https://doi.org/10.37290/ijpp2641-7197.16:22-30>

9. Noninvasive Imaging And Quantification Of Bile Salt Hydrolase Activity: From Bacteria To Humans

The aim of probiotic and prebiotic supplements is to restore a healthy balance to the microbiome, but their effects are difficult to study. Researchers have developed a noninvasive chemical probe that measures the activity of BSH (an enzyme produced by bacteria that is key to their health-promoting effects) along the entire length of the gut probe.

This research could lead to better precision medicine treatments by providing a way for scientists to better understand how a person's individual gut health is connected to various human pathologies, or the origin and nature of human diseases.

Source: Elena Goun, Associate Professor, Department Of Chemistry At The University Of Missouri, Columbia, And The Swiss Federal Institute Of Technology, Lausanne. **Noninvasive Imaging And Quantification Of Bile Salt Hydrolase Activity: From Bacteria To Humans. Sci Adv, (2021) Feb 3;7(6):eaz9857, Doi: 10.1126/sciadv.aaz9857.**

10. Prebiotics In Atopic Dermatitis Prevention And Management

Atopic dermatitis (AD) is a common, chronic inflammatory skin disease that is highly prevalent, especially among children. In addition to impaired skin barrier functions, AD is characterized by dysfunctional immunity and altered skin and gut microbiome. On the skin, there is an increased *S. aureus* colonization and reduced microbiome diversity while in the gut there is a diminution of short-chain fatty acid-producing bacteria, such as *Bifidobacterium*. There is no cure for AD, but symptoms can be managed by appropriate therapies aimed at minimizing exacerbations, and duration and degree of the AD flares. Functional foods, including probiotics and prebiotics, are being used to relieve AD symptoms. While probiotics supplement the gut with "good bacteria", prebiotics promote the growth of "good bacteria" on the skin and in the gut.

This study review immune dysfunction and microbiome association in atopic dermatitis (AD) and potential use of prebiotics in the prevention and management of AD.

Source: Thirumaran Thanabalu, School Of Biological Sciences, Nanyang Technological University, Singapore, 60 Nanyang Drive, Singapore. **Prebiotics In Atopic Dermatitis Prevention And Management. Journal of Functional Foods, Volume 78, March (2021), 104352.** <https://doi.org/10.1016/j.jff.2021.104352>

11. Water Soluble Dietary Fiber From Walnut Meal As A Prebiotic In Preventing Metabolic Syndrome

This study explores the potential health benefits of walnut meal dietary fiber (WMDF) as a prebiotic. Researchers investigated the functional role of WMDF on metabolic syndrome which was induced in mice by high fructose diet (20%, HF).

The animal experiment results show that administration of WMDF to HF-fed mice alleviated abnormal body weight gain, insulin resistance, oxidative stress, lipid metabolism disorders and inflammation. Histopathological observation confirmed the preventative effects of WMDF on hepatic steatosis and vascular endothelial dysfunction. Also, WMDF intake increased the production of acetic acid, propionic acid and butyric acid. Moreover, WMDF ingestion effectively improved the disorder of gut microbiota caused by HF, increased the diversity of gut microbiota and the relative abundance of short-chain fatty acids-producing bacteria.

These findings demonstrate WMDF can be used as a prebiotic to prevent HF-induced metabolic syndrome.

Source: Youlin Zhang, West Chang'an Avenue, Chang'an District, Xi'an 710119, China. **14. Water Soluble Dietary Fiber From Walnut Meal As A Prebiotic In Preventing Metabolic Syndrome. Journal of Functional Foods, Volume 78, March (2021), 104358.** <https://doi.org/10.1016/j.jff.2021.104358>

12. Biosynthesis, Structural Characteristics And Prebiotic Properties Of Maltitol-Based Acceptor Products

This study investigates the novel prebiotic candidates like maltitol derivatives which were obtained through alternansucrase-catalyzed reaction between sucrose and maltitol and their structural characteristics and in vitro fermentation.

Researchers have found that the reaction parameters, including the ratio of sucrose to maltitol, substrate concentration and reaction time, were optimized with the yield of 44.9% as well as 89.6 mg/mL of maltitol derivatives. These maltitol derivatives included α -D-Glcp-(1 \rightarrow 6)- α -D-Glcp-(1 \rightarrow 4)-D-Gol (DP3-H), α -D-Glcp-(1 \rightarrow 3)- α -D-Glcp-(1 \rightarrow 6)- α -D-Glcp-(1 \rightarrow 4)-D-Gol (DP4-H) and α -D-Glcp-(1 \rightarrow 6)- α -D-Glcp-(1 \rightarrow 3)- α -D-Glcp-(1 \rightarrow 6)- α -D-Glcp-(1 \rightarrow 4)-D-Gol (DP5-H). Similar to fructooligosaccharides, they showed the prebiotic activity. Specifically, the highest increase of Bifidobacteria was observed in the cultures supplemented with both DP4-H and DP5-H, whereas the most significant proliferation of Lactobacillus occurred in the culture supplemented with DP3-H. Moreover, fermentation of DP4-H resulted in the highest contents of butyrate and total short-chain fatty acids, which might be related to the highest α -(1 \rightarrow 3) bond content.

Study results suggested that the maltitol-receptor products via alternansucrase-catalyzed acceptor reaction were the prebiotic ingredient candidates and the prebiotic activity of maltitol derivatives depended on the type of the glycosidic bond.

Source: Ming Miaoa, State Key Laboratory Of Food Science And Technology, Jiangnan University, Wuxi, Jiangsu 214122, PR China. **Biosynthesis, Structural Characteristics And Prebiotic Properties Of Maltitol-Based Acceptor Products.** *Journal of Functional Foods*, Volume 78, March (2021), 104374. <https://doi.org/10.1016/j.jff.2021.104374>

*Note: Only lead author's names and their affiliations are given. Please see the articles for full details.
(Disclaimer-ILSI/ ILSI India are not responsible for veracity of any statement or finding)*