

Invited Editorial



Potential role of probiotic supplementation in cognitive improvement and other metabolic biomarkers

Phakharawat Sittipraporn^{id}

Head, Neuropsychological Research Laboratory

Head, Neuroscience Research Center

School of Anti-Aging and Regenerative Medicine, Mae Fah Luang University,
Bangkok, Thailand

Gut dysbiosis and changes in gut homeostasis, waves were also tracked using which are linked to a number of physical and electroencephalographic (EEG) recordings. mental problems, affect the connection between Quinolinic acid (QA, a tryptophan metabolite), the gut and the brain. Probiotics are considered and 5-hydroxyindoleacetic acid (5-HIAA, a dietary supplements that can be used to treat serotonin metabolite), were measured in urine at mental illnesses and cognitive issues. Probiotics the start of the study and 12 weeks later. Both the are live bacteria that, when consumed in QA and 5-HIAA concentrations significantly sufficient quantities, benefit the host's health. decreased and increased, respectively. The QA/5-HIAA ratio also decreased significantly. Probiotics can improve cognitive performance by HIAA ratio also decreased significantly. improving the gut-brain axis and the microbial According to the go/no-go test, the percentages of environment in the gut.⁽¹⁾ Cognitive development go accuracy and go error increased and decreased refers to a child's ability to think, reason, and use dramatically, respectively. In terms of EEG data, language, all of which are necessary for their theta, alpha, and beta waves were significantly overall development. Attention deficit/ changed between the study's baseline and 12th hyperactivity disorder (ADHD) is the most week. The data revealed that *Lactobacillus* common problem with a child's brain *paracasei* HII01 may improve gut flora and development, which occurs in parallel to the oscillatory brain activity, hence preserving the child's cognition. Attention deficit/hyperactivity attention states of persons.⁽¹⁾ disorder is caused by a number of factors, of especially in fast-paced environments where we are more prone to stress. It is believed that which gut homeostasis and gut microbiota are stress management increases longevity. The use of probiotics for psychological treatment is two of the most important ones.⁽¹⁾ Fukngoen et supported by a small body of diversely al.⁽¹⁾ recently investigated the effect of established evidence.⁽²⁾ There are currently few *Lactobacillus paracasei* HII01 on the attention state of healthy children as well as changes in studies on the use of synbiotics to reduce stress in stressed subjects. Lalitsuradej et al.⁽²⁾ representative neuroinflammatory markers. They recently investigated how synbiotics affected predicted that taking *Lactobacillus paracasei* stress levels in a Thai population. A Thai Stress HII01 could reduce the risk of developing neuropsychiatric disorders. Ten healthy young Test (TST) was used to screen 32 people and Thai children were given 109 CFU of and determine how stressed they were. Participants *Lactobacillus paracasei* HII01 daily for 12 weeks were divided into two groups: stressed and in this study. The go/no-go activities were used to assess changes in attention state. Changes in brain

*Email: wichian.sit@mfu.ac.th
ORCID ID: 0000-0002-4103-9396

non-stressed. Synbiotic preparation contained 10g of prebiotics (5g galacto-oligosaccharides (GOS) and 5g oligofructose (FOS)), and a combination of 2 probiotic strains at a total concentration of 1×10^{10} CFU/day (5.0×10^9 CFU of *Lactobacillus paracasei* HII01 and 5.0×10^9 CFU of *Bifidobacterium animalis* subsp. *lactis*). All parameters were measured at the start of the trial and again after the 12th week. Synbiotics significantly reduced the negative and positive TST scale scores in the stressed group, but increased the corresponding scores in the non-stressed group ($p < 0.05$).⁽²⁾ Synbiotics significantly decreased tryptophan levels in the non-stressed group ($p < 0.05$), but significantly increased levels of dehydroepiandrosterone sulfate (DHEA-S), tumor necrosis factor- α (TNF- α), 5-hydroxyindoleacetic acid (5-HIAA), short-chain fatty acids (SCFAs), acetate, and propionate. Both groups had lower levels of cortisol and lipopolysaccharide (LPS), but higher levels of interleukin-10 (IL-10) and immunoglobulin A (IgA). The synbiotics administration slightly improved stress status in the stressed group but not in the non-stressed group.⁽²⁾

Obesity, dyslipidemia, hypertension, and glucose intolerance are metabolic conditions that increase the risk of type 2 diabetes and cardiovascular disease. According to emerging evidence, microbiota may play an important role in human health and disease, including digestion, energy and glucose metabolism, immunomodulation, and brain function. Obesity is becoming more common, and the primary causes are overly processed diets and sedentary lifestyles. Furthermore, hypercholesterolemia is a major contributor to cardiovascular disease. Probiotics may benefit patients with hypercholesterolemia by lowering their high blood lipid levels.⁽³⁾ Chaiyasut et al.⁽³⁾ recently proposed a method for comprehending and elucidating the synergistic role of prebiotics and probiotics in the treatment of obesity. Obese Thai people were tested for biomarkers of obesity such as cholesterol, gut permeability, oxidative stress, bacterial toxins, cytokines, and short-chain fatty

acids after being given a synbiotic supplement containing *Lactobacillus paracasei*, *Bifidobacterium longum*, *Bifidobacterium breve*, inulin, and fructooligosaccharide. The results showed that including synbiotics in one's diet had a significant and positive effect on biomarkers linked to obesity.⁽³⁾ In another study, Chaiyasut et al.⁽⁴⁾ investigated 52 subjects randomly divided into two groups, the *Lactobacillus paracasei* HII01 treatment group and the placebo group, to understand how *Lactobacillus paracasei* HII01 affects cholesterol, oxidative stress, and other indicators. The study was conducted over a 12-week supplemental intervention period. *Lactobacillus paracasei* HII01 significantly improved the subjects' high density lipoprotein (HDL), total antioxidant capacity (TAC), and propionic acid levels while significantly lowering their total cholesterol (TCH), triglycerides (TGs), tumor necrosis factor- α (TNF), and lipopolysaccharide (LPS). The findings suggest that *Lactobacillus paracasei* HII01 improves blood lipid profiles and reduces oxidative stress in Thai hypercholesterolemic subjects.⁽⁴⁾

Bacteria, poisons, and allergens are prevented from diffusing into surrounding tissue and the circulatory system by the integrity of the intestines. Inflammation, gastrointestinal issues, neurological diseases, and neurodegenerative disorders are just a few of the minor to major health issues that can arise as a result of intestinal integrity damage.⁽⁵⁾ It is essential to maintain a healthy gut barrier function in order to preserve health. Protecting and restoring intestinal permeability in vitro and in vivo are known features of probiotics. Multiple strains of probiotics are more effective in protecting the body than a single strain. The effects of probiotic supplementation on intestinal permeability, lipid profile, obesity index, and metabolic indicators in elderly Thai participants were recently analyzed by Chaiyasut et al.⁽⁵⁾ The probiotic supplementation included *Lactobacillus paracasei* HII01, *Bifidobacterium breve*, and *Bifidobacterium longum*. The results

demonstrated that supplementation with the investigated probiotics significantly boosted high-density lipoprotein (HDL) cholesterol (up to 48%) and enhanced the function of the intestinal barrier. Furthermore, the intervention increased short-chain fatty acid levels as well as anthropometric indicators associated with obesity in humans. This study began with the goal of developing probiotic-based health supplements as an adjunctive therapy for a variety of metabolic diseases.⁽⁵⁾ In contrast, a randomised, double-blind, placebo-controlled trial to assess whether a 12-week B. breve A1 supplementation could affect the cognitive function of elderly subjects with memory complaints, showed that no significant intergroup difference was observed in terms of changes in scores from the baseline scores.⁽⁶⁾

The recent studies' restricted sample size, the questionnaire about eating habits, exercise, work activity, and overcoming the disease, the lack of extended follow-up, and microbiome analysis, must be supported by further studies. To prove probiotics' benefits and develop health supplements to treat metabolic illnesses, more research is needed.

REFERENCES

1. Fukngoen, P, Sivamaruthi, BS, Sirilun, S, et al. The influence of *Lactobacillus paracasei* HII01 supplementation on performance in attention (Go/No-Go) tasks and quinolinic acid and 5-hydroxyindoleacetic acid levels in Thai children-

- a preliminary study. *Appl Sci* 2022;12:5658. <https://doi.org/10.3390/app12115658>.
2. Lalitsuradej E, Sirilun S, Sittiprapaporn P, et al. The effects of synbiotics administration on stress related parameters in Thai subjects: a preliminary study. *Foods* 2022;11:759. <https://doi.org/10.3390/foods11050759>.
3. Chaiyasut C, Sivamaruthi BS, Kesika P, et al. Synbiotic supplementation improves obesity index and metabolic biomarkers in Thai obese adults: a randomized clinical trial. *Foods* 2021; 10:1580. <https://doi.org/10.3390/foods10071580>.
4. Chaiyasut C, Tirawat Y, Sivamaruthi BS, et al. Effect of *Lactobacillus paracasei* HII01 supplementation on total cholesterol, and on the parameters of lipid and carbohydrate metabolism, oxidative stress, inflammation and digestion in Thai hypercholesterolemic subjects. *Appl Sci* 2021; 11:4333. <https://doi.org/10.3390/app11104333>.
5. Chaiyasut C, Sivamaruthi BS, Lailerd N, et al. Probiotics supplementation improves intestinal permeability, obesity index and metabolic biomarkers in elderly Thai subjects: a randomized controlled trial. *Foods* 2022;11:268. <https://doi.org/10.3390/foods11030268>.
6. Kobayashi Y, Kuhara T, Oki M, Xiao JZ. Effects of *Bifidobacterium breve* A1 on the cognitive function of older adults with memory complaints: a randomised, double-blind, placebo-controlled trial. *Benef Microbes* 2019;10:511-20. <https://doi.org/10.3920/BM2018.0170>.