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INFLUENCE OF PROBIOTICS ON PHYSICALPERFORMANCE- AN OVERVIEW

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Abstract

This article discusses the relationship between gut microbiota and chronic diseases as well as athletic performance. Gut microbiota, a vast collection of microorganisms, plays a vital role in the synthesis of vitamins and essential amino acids, modulation of the immune system, management of oxidative stress and inflammatory responses, and other functions. Research has shown that the diversity and function of gut microbiota can be altered by dietary changes and physical activity, suggesting that modifying gut microbiota may be a suitable target for nutritional and physical activity interventions aimed at improving health and/or performance. Furthermore, probiotics have been used in sports to treat gastrointestinal problems and lower the likelihood of respiratory infections. The article emphasizes the potential of a combination of nutritional and physical activity interventions for the modification of gut microbiota to prevent and/or treat various chronic diseases or enhance performance in elite athletes.

Keywords- Probiotics, Gut microbes, Athletic performance, Health, Physical Activity

INTRODUCTION

It has long been believed that gut bacteria may affect both health and athletic performance. Due to the widespread sequencing of gut microbiota samples in the 2010s made possible by technological developments in high-throughput sequencing and bioinformatics analyses, as well as more recently, the creation of techniques to quantify various microbial metabolites, population-level studies on the human microbiota were possible. Their research contributes to a greater understanding of the microbiota's involvement in physiology and its functional imbalance in a variety of chronic illnesses(MetaHIT Consortium et al., 2010).The vast collection of microbes known as the gut microbiota persistently colonises the intestinal surface. It has 1014 resident microorganisms, including fungi, viruses, bacteria, and archaea. In healthy individuals, four groups predominate the gut microbiota: Firmicutes, Proteobacteria, Actinobacteria, and Bacteroidetes(Altenhoefer et al., 2004). They perform a wide range of tasks, including the synthesis of vitamins and essential amino acids, modulation of the immune system, management of oxidative stress and inflammatory responses, maturation of the nervous system through the release of neuroactive molecules, among other things. They also ferment, digest, and absorb nutrients needed for the body to obtain energy and maintain homeostasis(Cox et al., 2010).The International Olympic Committee (IOC) selected probiotics as a supplement in 2018 that was "moderately effective in supporting immune health to reduce the impact of respiratory tract infections," and that "further research is necessary to clarify impact on gut-related issues and

infections," according to the IOC. An outstanding description of the mechanisms and existing studies regarding the use of probiotic supplements in athletes for the promotion of health, improvement of sports performance, and recovery from exercise is provided by a recent position stand of the International Society of Sports Nutrition.This article explores the relationship between gut microbiota and chronic diseases as well as athletic performance. Mechanistic studies using gnotobiotic model organisms have provided new insights into the molecular mechanisms involved and offer opportunities to test methods to modulate gut microbiota composition. The article summarizes existing knowledge on the mechanisms underlying gut microbiota's impact on chronic diseases and sports performance, and then focuses on the combined effect of physical activity and nutritional interventions to alter gut microbiota composition for improved health and performance. The hypothesis is that these interventions' underlying mechanisms may interact to enhance their effects. This new knowledge could inform the development of strategies such as dietary changes, supplementation, and physical activity programs aimed at modifying gut microbiota to prevent and/or treat various chronic diseases or enhance performance in elite athletes.

Search Strategy and Selection Criteria

For the review of the current research studies relating to probiotics and gut health in athletes, PubMed was searched using the terms (athlete or "exercise training" or sport) andprobiotic with filtering to1541 studies were found. Screening of titles and abstracts was used to narrow the search to original research articles that included measurements relating to gut health including barrier function, gastrointestinal disturbances, and mucosal immunity. Search results were validated by cross-checking with recent review studies. Additional research articles related to gut health, probiotics, and the gut microbiome were used to describe and explain background and mechanisms.

Gut Microbiota Modulation by Exercise andNutrition for Health and/or Performance

Research has demonstrated that gut microbiota diversity and function can be altered by dietary changes and physical activity, leading to an impact on the host's physiology. This suggests that modifying gut microbiota may be a suitable target for nutritional and physical activity interventions aimed at improving health and/or performance. Interestingly, while both interventions are commonly implemented, there have been no human studies that have investigated the association between diet modulation and physical activity programs, with the exception of studies that combined probiotic consumption with high-level sports practice(Shing et al., 2014). In a review, some researcher evidence(Grobbelaar et al., 2012)suggested the potential benefit of various nutritional supplements in modulating gut microbiota composition to enhance athletic performance. However, there have been no human studies that have compared the effects of controlled physical training and nutritional intake on gut microbiota composition changes. Combining these interventions may have additional and synergistic effects, as seen in recent animal studies(Rehrer et al., 2013).

Probiotics, Athletes, and Performance

According to Jäger and his colleagues published an article and they mention gastrointestinal problems, including as nausea, vomiting, abdominal discomfort, and bloody diarrhoea, are quite common among endurance athletes. Athletes who overtrain, experience psychological stress, get little sleep, and compete in harsh environments are also more likely to experience immunological depression, which can make them more susceptible to respiratory infections. As a result, probiotics are now more frequently used in sports, primarily to treat gastrointestinal problems and lower the likelihood of respiratory infections(Saad et al., 2013).Overall, a favourable effect has been shown. Results vary depending on the probiotic strain, dosage, length of time taken, and even

the administration form (capsules, sachets, or fermented milk). Reduced GI symptoms and lower incidence of respiratory tract infections appear to be benefits of taking multi-strain probiotics in sachets or as fermented foods over an extended period of time(Abreu & Arditi, 2004).The beneficial effects of probiotics are likely due to multiple factors, including improved barrier function, increased immune cell activity (mediated by pro-/anti-inflammatory pathways and immunoglobulin production), increased production of short-chain fatty acids (SCFA), decreased intestinal pH, and increased mucus production. Probiotics may also improve immune function in athletes by promoting interferon gamma production by T lymphocytes and possibly enhancing immunoglobulin A production by B lymphocytes. In addition, Lamprecht et al. hypothesised that probiotics could stimulate the activation of Toll-like receptor 2 (TLR2), which can result in the production of tight junction proteins, particularly zonulin. This decreases intestinal permeability, endotoxemia, and gastrointestinal symptoms.

Probiotics can also affect the composition of gut microbiota. For instance, a study by West et al. showed that after 11 weeks of L. fermentum supplementation, there was a 7-fold increase in the Lactobacillus genus among both male and female competitive cyclists. Similarly, Martarelli et al. found that supplementation with Lactobacillus species during 4 weeks of intense physical activity significantly increased the fecal Lactobacillus count in athletes. However, these results were not associated with an increase in physical performance. Some data suggest that probiotics may have positive effects on sports performance, either directly or indirectly, as reviewed by the International Society of Sports Nutrition in 2019. For example, a double-blind placebo-controlled trial by Huang et al. found that 6 weeks of Lactobacillus plantarum TWK10 supplementation at low and high doses prolonged the time to exhaustion during an 85% VO2 max exercise in a dose-dependent manner and decreased serum lactate levels during exercise and recovery. Another recent study using a different Lactobacillus plantarum strain (PS128) found that 4-week supplementation was associated with a decrease in the concentration of muscle damage and oxidative stress systemic markers after a half-marathon in recreational runners, without changes in their exercise capacity. Therefore, while the ergogenic results of probiotics are not always clear, they might help improve recovery by promoting muscle repair through increased protein synthesis(Alliet et al., 2007).

Optimising Health Through Modulation of Gut Microbiota through the Use of Supplements and Exercise Programmes

Lifestyle interventions, such as diet and/or physical activity programs, can help to improve the metabolic profile of patients with obesity, type 2 diabetes, IBD, and other metabolic diseases. The American College of Sports Medicine recommends regular (150 min/week) low- to moderate-intensity continuous training for patients with obesity, (pre)diabetes, and other metabolic problems. HIIT, defined as short bursts of intense activity interspersed by periods of low-intensity exercise or rest, is considered a time-efficient and safe exercise mode to reduce total fat mass, improve glucose metabolism, and modulate gut microbiota composition(Alvarez-Olmos & Oberhelman, 2001). Our group tested the impact on gut microbiota modulation of a 12-week HIIT program combined with a polyphenol-rich extract from five plants (olive leaves, bilberry, artichoke, chrysanthellum, and black pepper).it was found that HIIT, combined with Totum-63 supplementation, altered the body composition and glycemic profile in a rat model of pre-obesity, specifically by modulating the The combination of physical activity (HIIT) and n-3 PUFA supplementation (i.e., the addition of linseed oil (LO) in the diet) on body composition and metabolic profile changes in a rodent model of obesity was evaluated. Results showed that HIIT significantly reduced total body fat mass and that the HIIT + LO combination improved alpha-linolenic acid to docosahexaenoic acid conversion and increased the relative abundance of

Anaeroplasmaceae, Christensenellaceae and Oscillospira bacteria in the colon microbiota. Oscillospira abundance was negatively correlated with weight and fat mass gain. Prevotella also increased in the HIIT and HIIT + LO groups, and its abundance was negatively correlated with weight and fat mass gain. Thus, the combination of HIIT and LO could be proposed for the management of metabolic diseases, such as obesity(Boehm et al., 2007).

Conclusion and discussion

The discovery of the gut microbiota community has opened a promising and rapidly growing research field on the potential beneficial health effects of manipulating the gut microbiota. Human studies are still limited, but National Gut Human Projects have been set up to collect human fecal samples and to correlate the obtained microbiota results with the host's characteristics. The Million Microbiome of Humans Project (MMHP) is a major international project, aiming to create the largest human microbiota database in the world, analyse 1 million samples, and explore the full microbiome potential. Interventional studies to modulate the gut microbiota composition will be a major milestone. The gut can adapt its bacterial community to external factors, such as nutrition and physical activity.To optimize the nutrition-gut microbiota-physical activity triad for each patient or athlete, HIIT with n-3 PUFA or polyphenol-rich extract supplementation appears to be a promising combination. However, it is essential to develop innovative, original and promising microbiota-based strategies coupled with physical activity programs to optimize sports performance and medical treatments or to delay disease onset. Outreach programs should also include the triad concept to develop individualized microbiota-based strategies for health and sports performance management.

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