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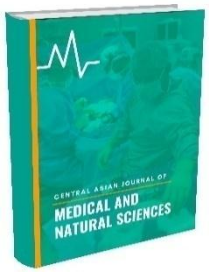

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Role of Microbes in Performance and Health of Sportsman

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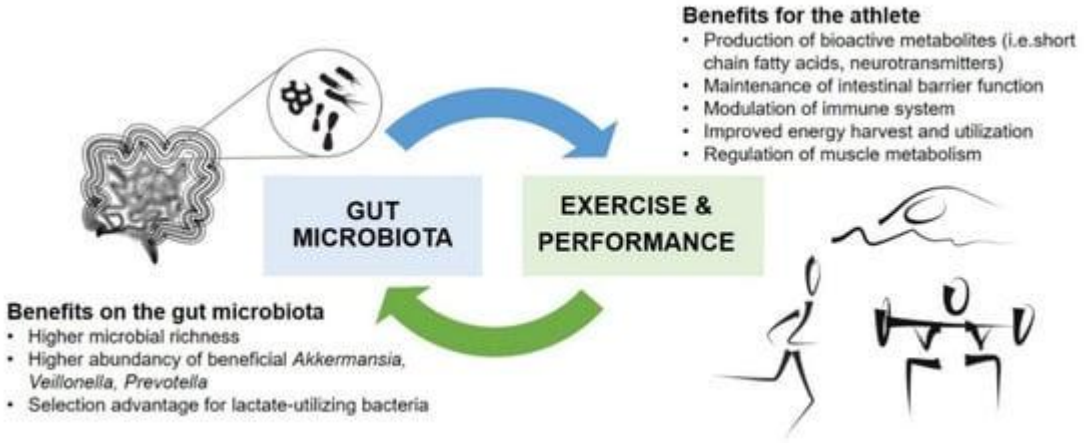
Abstract: The human intestinal tract is home to approximately 100 trillion microbes with the majority of these residing in the colon. Most microbes in the human intestinal tract are bacteria but archaea, fungi, protozoans and a large population of viruses are also present. These microbes have a vast array of functions including vitamin production, fibre digestion, interacting with the immune system and they contribute significantly to health and disease. Previously, it was only possible to study the human gut microbiota (GM; microbiota refers to the assemblage of microorganisms present in a defined environment) after first culturing the microbes on agar plates. Gut microbes have an extremely specific set of growth conditions in vivo that are difficult to recreate in a lab environment. Advancement in DNA sequencing technology has made it possible to study the genetic material of the microbes present and negates the need for culture. Increased understanding of the role of GM has led to innovative methods to alter gut microbe composition and subsequently GM function. These microbes are also provided through neutraceuticals to sportsman for increasing their boost and health.

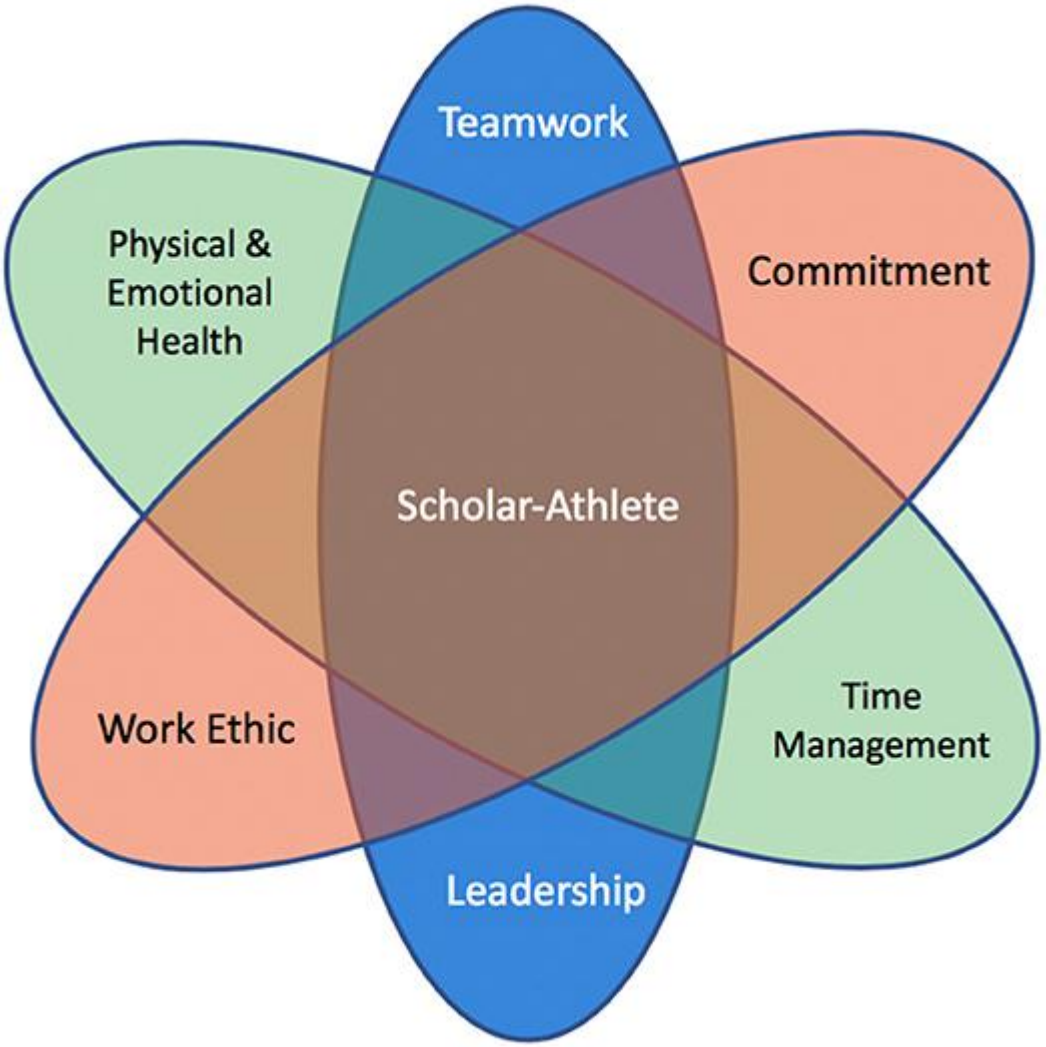
Key words: gut microbes, human, health, sportsman, DNA, bacteria, viruses, immune, disease.

INTRODUCTION

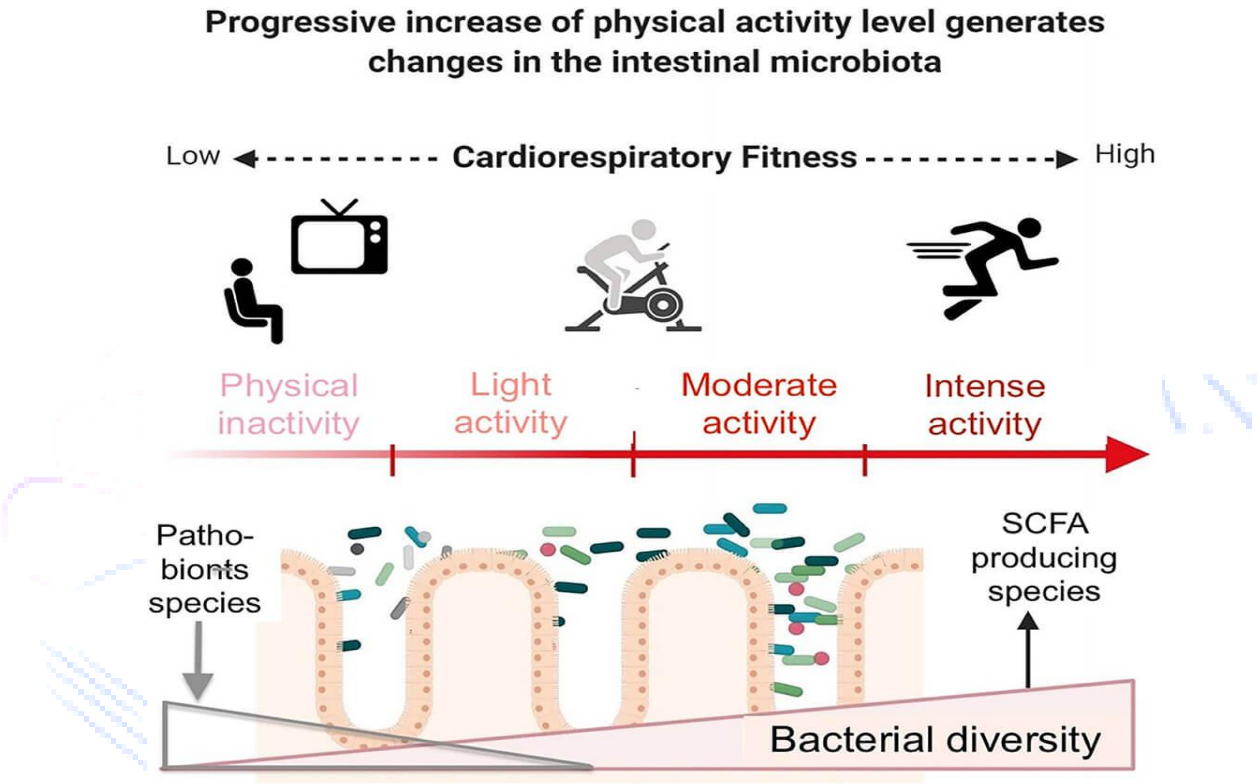
The sportsmen's goal is to optimize their performance. Towards this end, nutrition has been used to improve the health of sportsmen's brains, bones, muscles, and cardiovascular system. However, recent research suggests that the gut and its resident microbiota may also play a role in sportsmen health and performance. [1]



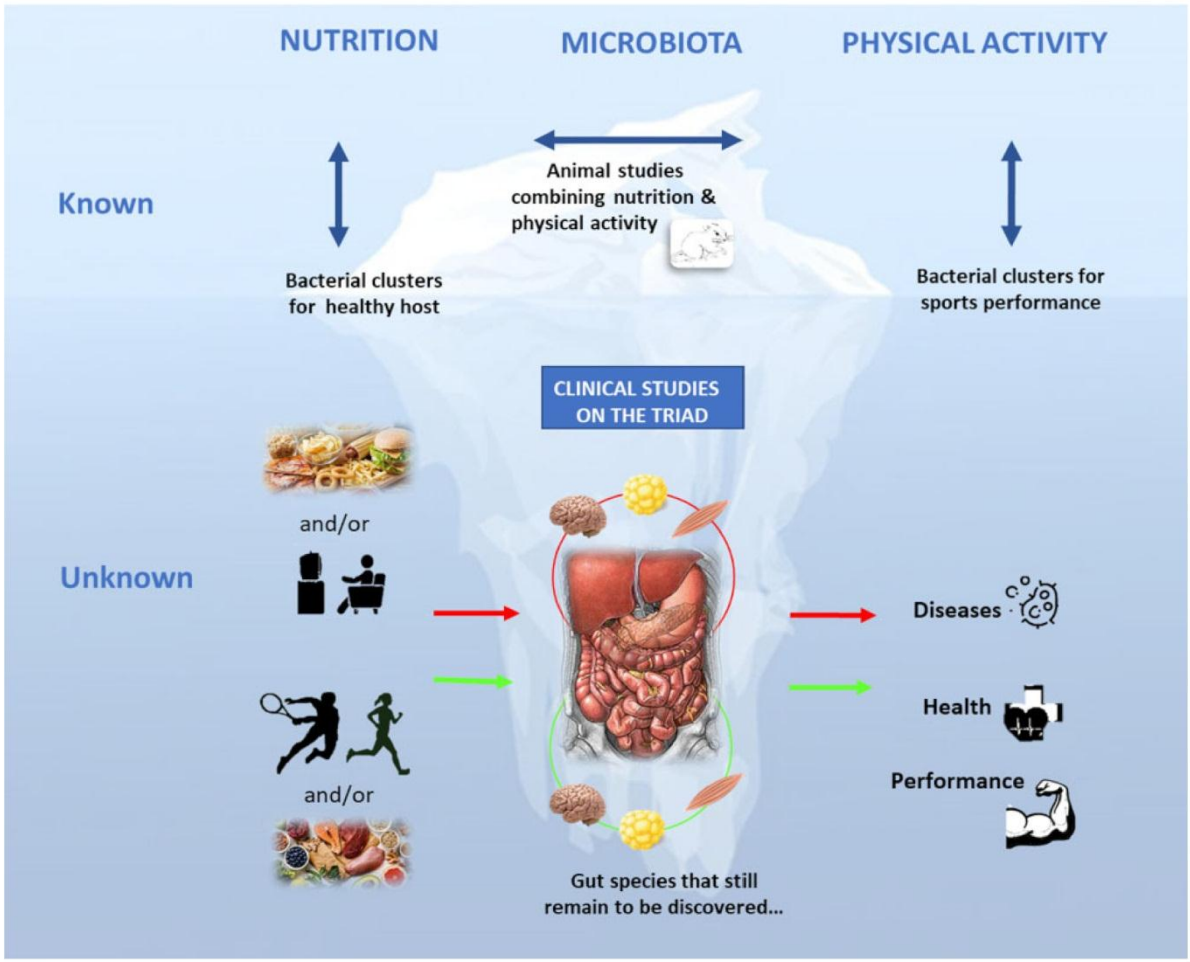
Therefore, sportsmen should consider dietary strategies in the context of their potential effects on thegut microbiota, including the impact of sports-centric dietary strategies (e.g., protein supplements, carbohydrate loading) on the gut microbiota as well as the effects of gut-centric dietary strategies (e.g., probiotics, prebiotics) on performance. This review provides an overview of the interaction between diet, exercise, and the gut microbiota, focusing on dietary strategies that may impact both the gut microbiota and athletic performance.



Current evidence suggests that the gut microbiota could, in theory, contribute to the effects of dietary intake on athletic performance by influencing microbial metabolite production, gastrointestinal physiology, and immune modulation.[2] Common dietary strategies such as high protein and simple carbohydrate intake, low fiber intake, and food avoidance may adversely impact the gut microbiota and, in turn, performance. Conversely, intake of adequate dietary fiber, a variety of protein sources, and emphasis on unsaturated fats, especially omega-3 (ω-3) fatty acids, in addition to consumption of prebiotics, probiotics, and synbiotics, have shown promising results in optimizing sportsmen health and performance. Ultimately, while this is an emerging and promising area of research, more studies are needed that incorporate, control, and manipulate all 3 of these elements (i.e., diet, exercise, and gut microbiome) to provide recommendations for sportsmen on how to "fuel their microbes."[3]



Researchers headed by a team at the Joslin Diabetes Center and Harvard Medical School have identified a type of bacteria in the gut microbiomes of marathon runners—but not sedentary people—that can boost the capacity for exercise. Tests showed that mice inoculated with a strain of the bacterium Veillonella atypica isolated from elite sportsmen were able to run for longer on a treadmill than control animals. The researchers found that the Veillonella bacteria preferentially metabolize lactate, which muscles produced during hard exercise, and convert it to the short chain fatty acid (SCFA) propionate, which the body can then utilize to improve exercise performance. The researchers suggest that Veillonella could be formulated as a dietary supplement to help increase the level of health-promoting exercise that might be undertaken by individuals who can't normally exercise effectively.[4]

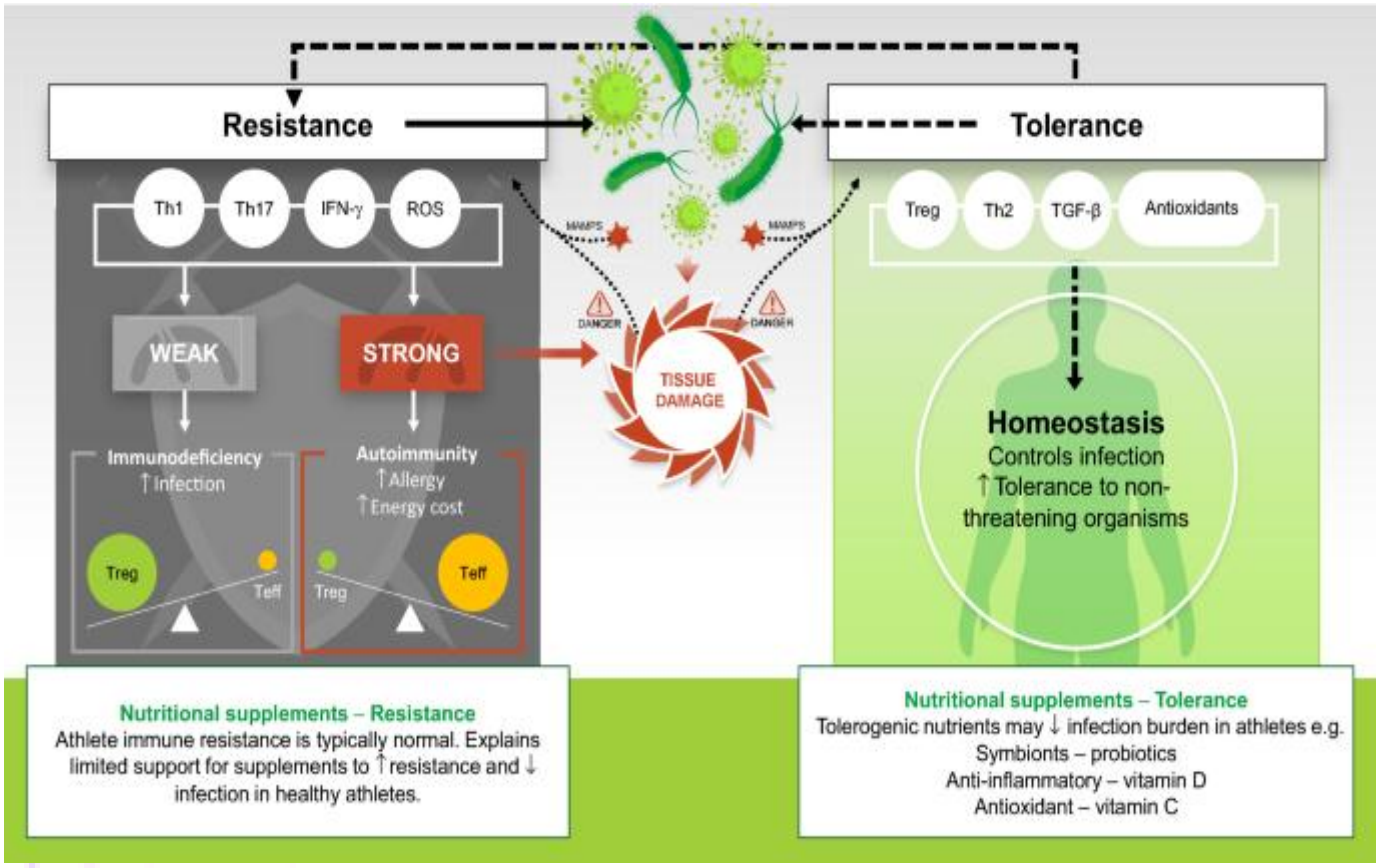


The gut microbiome is of crucial interest for players as research shows that when added, certain foods can release molecules that harm or heal the body. It has been found that microbial ecosystems are different in sportsmens pursuing different sports.

The microbiome is dynamic in nature and we are learning how it is unique and changes in performing elite sportsmen. We are leveraging this metagenomics information to develop nutritional supplements towards enhancing the performance and health of others.

DISCUSSION

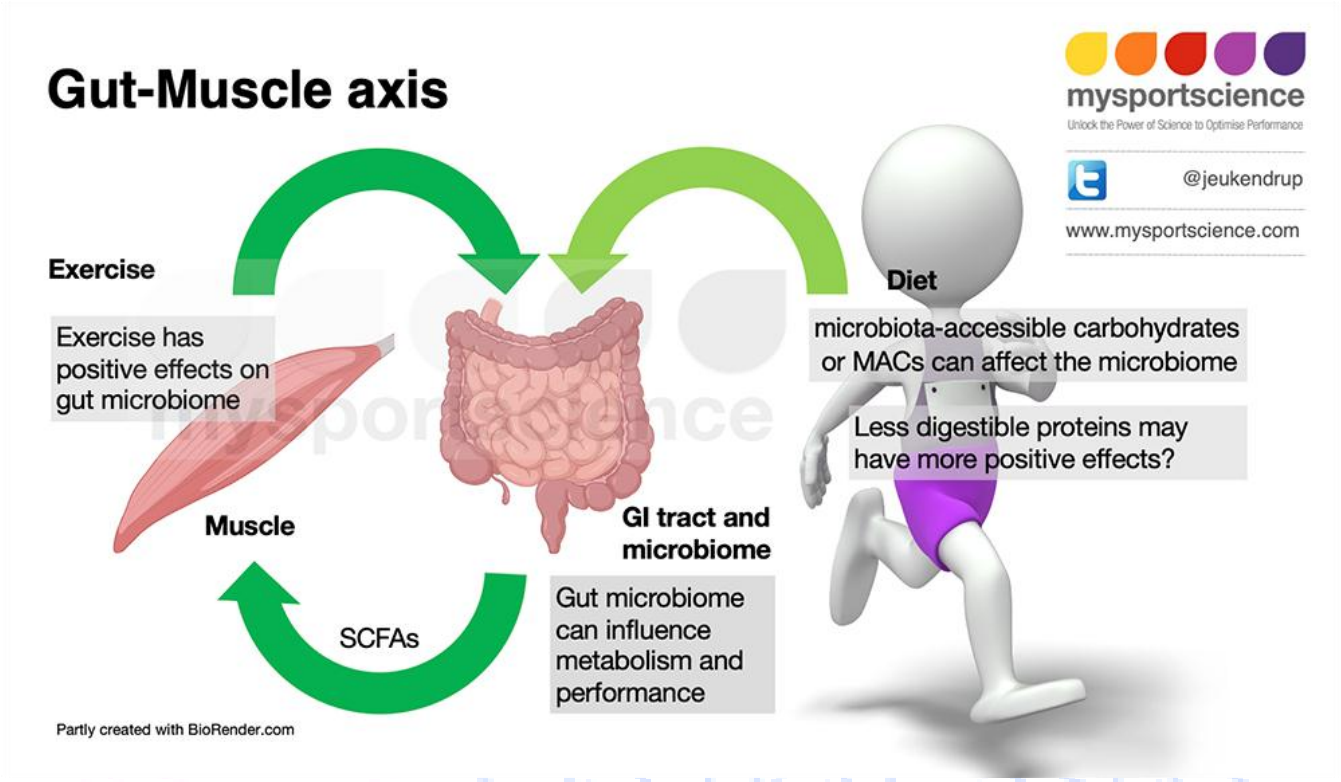
The physiological and biochemical demands of intense exercise elicit both muscle-based and systemic responses. The main adaptations to endurance exercise include the correction of electrolyte imbalance, a decrease in glycogen storage and the increase of oxidative stress, intestinal permeability, muscle damage, and systemic inflammatory response.[5]



Adaptations to exercise might be influenced by the gut microbiota, which plays an important role in the production, storage, and expenditure of energy obtained from the diet as well as in inflammation, redox reactions, and hydration status. Reviewed literature supports the hypothesis that intestinal microbiota might be able to provide a measureable, effective marker of an sportsmen's immune function and that microbial composition analysis might also be sensitive enough to detect exercise-induced stress and metabolic disorders. [6] The review also supports the hypothesis that modifying the microbiota through the use of probiotics could be an important therapeutic tool to improve overall general health, performance, and energy availability while controlling inflammation and redox levels in sportsperson.

Veillonella has a fairly unusual way of making a living — it eats lactate, a chemical byproduct of intense exercise that's associated with fatigue (though, contrary to popular belief, it doesn't actually cause muscles to hurt).

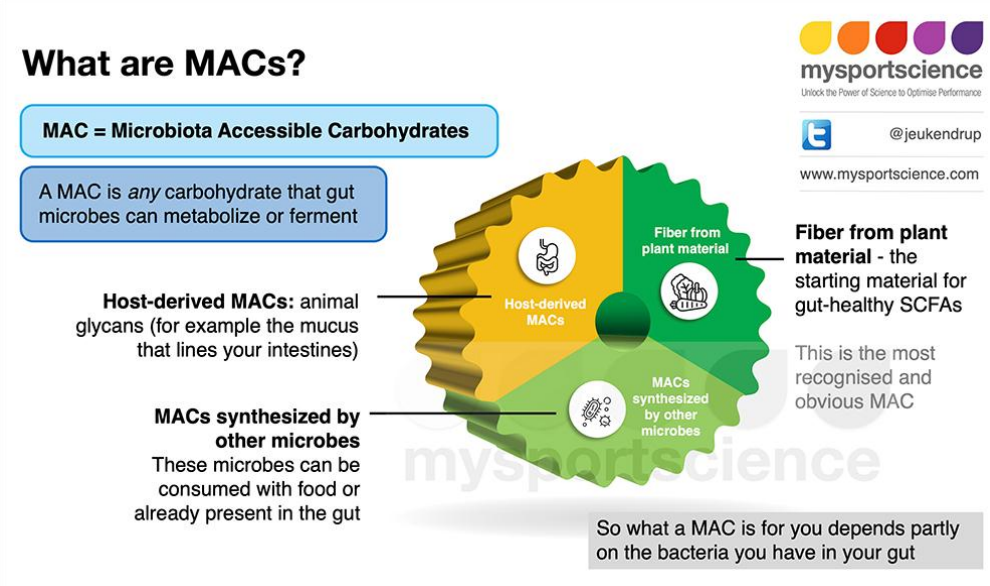
A study led by researchers at the University College Cork in Ireland, found that the gut microbiota of elite rugby players was significantly more diverse than that of non-sporties. More recently, researchers were able to identify differences in the composition of the sportsmen' microbiota sorted by type of sport. This matters because increased microbial diversity is linked to better immunity, higher resistance to upper respiratory tract illness, and lower rates of obesity. This can also have a knock-on effect on digestion, weight, mood and chronic disease risk. In another study, scientists at the University of Illinois at Urbana-Champaign, found that 6 weeks of endurance exercise improved the diversity of volunteers' gut microbes. When they stopped exercising, their microbiomes reverted to what they had been at the start of the study. These studies provide compelling evidence that exercise can induce changes in the gut microbiota independent of diet.[7]



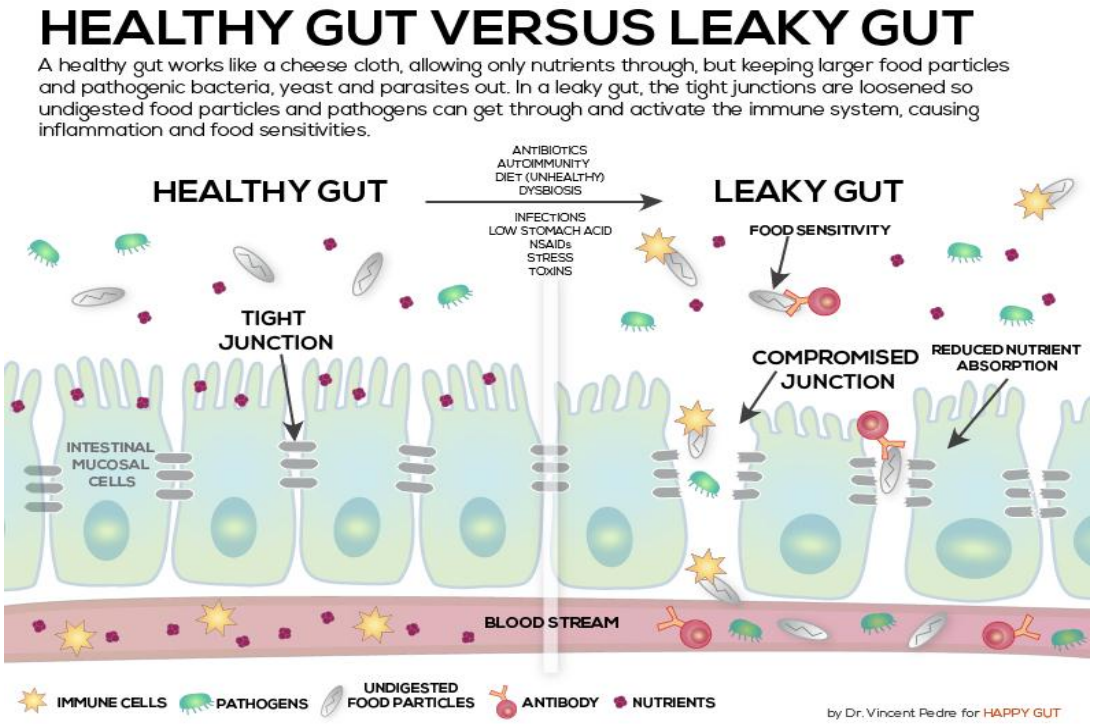
RESULTS

The best way to increase the diversity of gut microbes – and gain a performance advantage - is to eat a wide range of foods rich in fibre, polyphenols and prebiotics. These provide 'food' for 'good' gut microbes so they can grow. There are many types of fibre and the more types you eat the greater the benefit.

- Plant-based foods – Try to get as many different kinds of fruit, vegetables, whole grains, pulses, nuts and seeds in your diet as possible. Variety is key because each contains different nutrients that the gut microbes thrive on
- Berries, nuts, red wine and dark chocolate – contain polyphenols that encourage the growth of 'good' microbes
- Try fermented foods containing probiotics – these are the live bacteria found in yogurt, sourdough bread, unpasteurised cheeses, fermented vegetables, tempeh (fermented soya beans), kefir (a fermented milk drink), kombucha (fermented tea) and kimchi (fermented Chinese cabbage)
- Avoid highly processed foods – they contain ingredients that either suppress 'good' microbes or increase 'bad' microbes
- Focus on prebiotics – these are a type of dietary fibre that feed the 'good' microbes in your gut. Consuming more of them will increase the proportion of 'good' microbes. Foods rich in prebiotics include beans, lentils, chickpeas, Jerusalem artichokes, onions, garlic, asparagus and leeks.



The sportsmen microbiome is highly susceptible to bacterial imbalance due to poor dietary influences such as highly processed, inflammatory foods and sports drinks and supplements marketed to young sportsmens. Sportsmens have been shown to have a different microbial composition than non sportsmens. In a study published in the British Medical Journal, researchers discovered a significant difference in faecal microbial composition between elite sportsmens and sedentary individuals . This evidence supports the theory that exercise is beneficial for composition and function of the microbiota .The microbiome is a collection of trillions of commensal, symbiotic and pathogenic organisms (bacteria, fungi, viruses etc) that live within the human body . The microbiome can be a difficult aspect of the human body to grasp because it is invisible to the human eye. Sportsmen microbiome series will break down what your microbiome is, what factors influence the health of microbiome and dysbiosis. Microbiome can influence sportsmen performance , recovery and energy availability.[8]



As a sportsperson he or she may be interested in how to optimize performance, recovery and decrease risk of injury and sickness. There is emerging evidence that the microbiota may factor into sportsmen health, performance, energy availability and inflammation . Keep in mind that nothing can replace the combined value of proper nutrition, sleep, stress management and physical therapies for sportsmen health. However, combining recent advances in microbiota research with our current knowledge of sports nutrition is the perfect recipe for the ultimate performance enhancement strategy.

CONCLUSIONS

The microbiome is a vital and dynamic organ, yet the majority of sportsmens do not know it exists, nor how critical it is to overall health and well being. The majority of bacteria that comprise our microbiome live within our large intestine, but can also be found in the vaginal canal, oral mucosa and on the skin . These bacteria are the conductors of many of the body's physiological processes such as metabolic processes, immune function, nutrient absorption and digestion .If that isn't enough to spark some excitement, there is a bi-directional highway of communication that exists between our gut and our brain called the 'gut-brain-axis' .Communication on the gut-brain axis occurs primarily through the vagus nerve, neurotransmitters, neuropeptides and hormones . This phenomenon explains how the health of our gut can regulate mood disorders such as anxiety and depression .So as you can see, the microbiome plays many roles and functions within the body. It is best to think about the microbiome as a complex ecosystem of organisms, just as you might think of an ecosystem such as a rainforest. Within a rainforest you have many different plants and other species that rely heavily on each other for the survival of the forest as a whole. The same theory applies to your microbiome- a collection of biological organisms that interact with each other as well as their environment.[8]

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