Mini Review

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Metabolic syndrome, exercise and Gut Microbioma: Possible Correlation

Carmine Finelli[1] and Simone Dal Sasso[2]

[1]*Department of Internal Medicine, ASL Napoli 3 Sud, Hospital "A. Maresca" Via Montedoro, Italy*

[2]*Independent Researcher, Naples, Italy*

***Corresponding author:** Carmine Finelli, Department of Internal Medicine, ASL Napoli 3 Sud, Hospital "A. Maresca" Via Montedoro, Italy

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The metabolic syndrome is a rapidly developing health issue that impacts an estimated one-third of adults and a growing number of children in developed nations [1]. It includes the consequences of heart disease, atherosclerosis, insulin resistance, non-alcoholic fatty liver disease (NAFLD), and other conditions [2-4]. While studies are being conducted on combination and single medication therapy, there is currently no approved pharmaceutical treatment to address all, most, or even some components of the metabolic syndrome [5-7]. In an effort to reduce whole-body obesity, revert chronic hyperglycemia, avoid blood vessel plaque formation, and dyslipidemia, the current predominant therapy to combat the metabolic syndrome involves dietary changes and increased physical activity [8,9]. Exercise has been shown in clinical trials to lower hepatic lipid content and increase insulin sensitivity in people [10], but not all of the mechanisms via which exercise enhances the body's overall metabolism are understood, particularly when metabolic syndrome is either in the early stages of development or is already established [11,12].

Thus, it is essential to understand the molecular mechanisms behind the metabolic syndrome and how it progresses within the context of an exercise intervention in order to develop effective treatments and reduce the total burden on families, communities, healthcare systems, and individuals [13,14]. A host's gut microbiota is currently receiving more attention and been shown to affect a number of elements of the metabolic syndrome and the diseases that are linked to it [15,16]. After exercise measures, the gut microbiome is also being investigated; recent findings indicate a close connection between the advantages of physical activity and the gut microbiome [17-19]. This field of study is fascinating because of the possible effects on both individual and public health. Though the mechanisms under non-disease or athletic conditions have recently been defined not as much research has focused on whether physical activity preserves or promotes a diverse gut microbiome in the context of diet-induced metabolic syndrome and whether this impacts organismal metabolic health [20-23]. Recently, it was showed that reductions in caloric consumption and encouragement of physical activity in contrast to an ad libitum Mediterranean diet were linked to improvements in cardiometabolic risk variables, possibly via alterations in the metabolome and fecal microbiota [24].

Therefore, exercise has been demonstrated to have favorable effects on the gut microbiome and metabolism, and there is growing evidence that an unbalanced gut microbiota may contribute to insulin resistance in Type 2 Diabetes patients [25,26]. Over the last ten years, a number of studies have linked metabolic illnesses like obesity and type 2 diabetes (T2D) to the gut microbiota; however, the precise processes behind these associations remain unclear [27-30]. Insulin and blood sugar are key indicators of general metabolic health. The hormone insulin, which is secreted by the pancreas in response to carbohydrate consumption, controls blood sugar levels by enabling glu-

cose, or sugar, to enter our body's cells for energy [31]. Patients with metabolic diseases like TD2 experience insulin resistance, a condition in which the body's cells become less responsive to insulin, leading to excessively elevated blood sugar levels [11]. For unknown reasons, many patients do not respond to exercise or respond badly in terms of insulin sensitivity and blood sugar balance, despite the fact that regular exercise has been linked to several health advantages [32].

The microbiome of patients who reacted favorably to exercise seemed to include more bacteria that produce the anti-inflammatory metabolite short-chain fatty acids, which control glucose and energy balance [25-33]. On the other hand, the microbiome of non-responders showed a greater synthesis of substances like glutamate, which has been shown to be elevated in insulin-resistant individuals and to have a greater potential to cause inflammation [34]. Additionally, the gut microbiota composition of non-responders was comparable to that of the sedentary controls [17,35]. Therefore, the gut microbiota is a major determinant of an individual's ability to increase insulin sensitivity and blood sugar metabolism in response to exercise [36]. Depending on an individual's gut microbiota, the effectiveness of lifestyle treatments like diet and exercise that try to promote metabolic health appears to be very different. Personalized lifestyle interventions may eventually directly target the gut microbiota to enhance overall metabolic health.

It need to find out if endurance training is enough to stop or slow the onset of the metabolic syndrome and the disorders that are linked to it. It was investigated the effects of exercise on the gut microbiota as the metabolic syndrome progresses [36,37]. Important aspects also include the interplay between probiotics, exercise, the state of the host's internal environment, and the gut microbiota [38]. The development of the study topic shows a trend toward complete analysis that is multidisciplinary and multiperspective [38]. Because exercise controls the gut microbiota, it may prove to be a useful intervention in the treatment of disease [38]. The development of exercise-centered lifestyle intervention treatment has the potential to become a major trend in the next years [38]. Long-term exercise training reduced adiposity and liver lipid buildup while maintaining cardiometabolic fitness and glucose homeostasis [39]. A number of operational taxonomic units (gut bacteria) have been drastically altered and closely linked to markers of clinical significance [40]. Therefore, exercise has an impact on the gut microbiota across the initial stages and progression of metabolic syndrome, and studies on this subject constantly bolster the advantages of exercise for organisms' metabolic health.

Disclosure Statement

The authors declare that there are no conflicts of interest.

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