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# Impact of physical activity on gastrointestinal health and prevention and treatment of common gastrointestinal diseases: Irritable Bowel Syndrome and Inflammatory Bowel

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**Abstract**
Irritable Bowel Syndrome (IBS) and Inflammatory Bowel Diseases (IBD), among them Crohn's disease and ulcerative colitis, are common chronic diseases affecting a growing group of patients. Physical activity (PA) is an important part of a healthy lifestyle. The aim of the study was to critically evaluate current knowledge of impact of PA on gastrointestinal (GI) health and prevention and treatment of some most common GI tract diseases, such as IBS and IBD. The comprehensive research of literature available on PubMed, Google Scholar, ResearchGate and Springer Link was performed. PA improves function of GI by increasing colon transit and bowel movements. These mechanisms contribute to reducing the risk of colorectal cancer and, to varying degrees depending on location, other digestive-system cancers. There is a potential association between PA and the more health-beneficial gut microbiota, but more research in this area is needed. Sedentary lifestyle seems to be a risk factor for IBD, while physical activity seems to be a protective factor only for Crohn disease. Although, PA contributes to improvement of quality of life and reduction of stress in patients with IBD, further conclusions on the effect of PA on the course of ulcerative colitis and Crohn disease still require expanded research. Available literature suggests that physical activity prevents obesity, a proven risk factor for worsening the course of the disease, and osteoporosis, an important complication of glucocorticosteroid therapy. Despite evidence of a sedentary lifestyle as a risk factor for IBS, there is still a lack of studies examining the impact of physical activity as a protective factor. the number of RCTs examining the effect of PA on the course of IBS remains insufficient, and studies conducted should take into account the various symptoms of IBS.

**Keywords:** Irritable Bowel Syndrome (IBS), Inflammatory Bowel Diseases (IBD), physical activity, gastrointestinal health

## Introduction

### Irritable bowel syndrome

Irritable bowel syndrome (IBS) is one of the most common chronic gastrointestinal disorders. As a functional disease, IBS can be diagnosed after exclusion of any organic causes, when symptoms such as abdominal pain or discomfort with change of stool frequency occur. The prevalence of IBS is estimated between 10 and 15% and the most of the suffering patients never consult a physician regarding their symptoms [1]. Research conducted in the United States, Canada and Israel indicate that, IBS symptoms are 1.5 to 2 times more frequent among women than men [1]. The exact pathogenesis of IBS remains unclear, the most important factors include dysfunctions involving the brain-gut axis, motility and bowel immune system. Early life stressors, food intolerances, antibiotics and enteric infections are mentioned as environmental contributors to IBS [2]. The most common clinical manifestations of IBS include abdominal pain or discomfort, altered bowel habits with diarrhoea, constipation, or both.

The other symptoms are: bloating, distention, symptoms association with food intake, and a change in pain location and the form of the stool with time [2]. Diagnosis is based on clinical guidelines included in the Rome IV diagnostic criteria. It requires least 3 days a month in the last 3 months associated with 2 or more of the following: improvement in abdominal pain or discomfort with defecation, onset associated with altered bowel habits and/or an onset accompanied by a change in stool pattern [3]. The differential diagnosis should be adjusted depending on the clinical picture, whether constipation or diarrhoea predominates. During the diagnostics, red flags, such as unexplained weight loss or iron-deficiency anaemia, rectal bleeding, progressively worsening symptoms, new onset after age 50 years, family history of colorectal cancer, or celiac disease should be excluded [2]. Additionally, nocturnal gastrointestinal symptoms also suggest different diagnosis than IBS. Extensive testing in patients meeting clinical criteria for IBS and lacking alarm findings should not be performed [1]. But if the clinical picture is not typical of IBS or "red flags" are present, then expanding diagnostics should be performed, including: inflammatory markers, complete blood count, thyroid stimulating hormone level, stool tests for Clostridioides difficile, Giardia, or Cryptosporidium [1]. A colonoscopy may be also useful when a family history of IBD, colon cancer, celiac disease or other alarm findings occur [1]. Depending on the main symptom present, IBS can be divided into more specific diagnoses: IBS with diarrhoea (IBS-D), IBS with constipation (IBS-C) and IBS with mixed bowel patterns (IBS-M) [3]. Treatment of IBS requires a multifaceted approach. Developing a trusting patient-physician relationship seems to be crucial [2,5]. The therapeutic options range from lifestyle and dietary interventions to pharmacotherapy and psychological therapy [2].

**Inflammatory bowel diseases**

Inflammatory bowel disease (IBD) is a group of chronic, idiopathic inflammatory diseases with immune-mediated inflammation involving the gastrointestinal tract, the most common of which are ulcerative colitis (UC) and Crohn disease (CD). UC mainly affects the rectum, less often the entire colon, and is characterized by mucosal localization and continuous spread of inflammation, while inflammation in CD usually penetrates deeper into the gastrointestinal wall and can involve any segment of the gastrointestinal tract, most often affecting the terminal ileum and colon. Extraluminal complications such as osteoporosis, arthritis, primary sclerosing cholangitis and deep vein thrombosis can develop in the course of both IBD and CD [6]. The pathogenesis of IBD is multifactorial, but an inappropriate immune response to the gut microbiota appears to play a key role [7]. An estimated 2.5-3 million people in Europe suffer from these diseases (0.4% of the total population), and the prevalence is increasing [8]. The clinical manifestations of UC and CD can be similar, with symptoms such as abdominal pain, diarrhoea, weight loss or fever. The most common symptoms of UC are diarrhoea with mucus or blood, urinary urgency, and pain in the left lower quadrant of the abdomen. Symptoms of CD vary depending on which part of the gastrointestinal tract (GI) is affected, and are more often associated with fever, pain in the right lower quadrant, nausea and vomiting, weight loss, anal fistulas [7]. Endoscopy to obtain a biopsy is essential to confirm the diagnosis of IBD. Treatment of IBD is aimed at inducing remission of the disease [7]. Available treatment options include pharmacotherapy, with corticosteroids, aminosalicylate agents or immunosuppressants such as TNF-alpha monoclonal antibodies (infliximab), azathioprine, methotrexate [7].

In some cases, such as severe fistula disease, surgical interventions are necessary. Dietary and psychological interventions are also an important therapeutic branch [7].

**Aim of the study**

The aim of the study was to critically evaluate current knowledge of impact of physical activity on gastrointestinal health and some most common GI tract diseases, such as IBS and IBD, paying attention to the role of PA in both prevention and treating of these diseases.

**Methods**

Comprehensive research and analysis of literature available on PubMed, Google Scholar, ResearchGate and Springer Link were performed. These databases were searched using the following keywords: "Irritable Bowel Syndrome," "IBS," "Inflammatory bowel disease" "IBD", “Crohn disease”, “CD”, “ulcerative colitis”, “UC”, "physical activity" "physical exercises" and "gastrointestinal health.". Peer-reviewed studies, including randomized controlled trials, systematic reviews, and observational studies, were included to obtain a high-quality evaluation.

**The overall impact of physical activity on health, with a particular focus on gastrointestinal tract**

Recent World Health Organisation (WHO) guidelines on physical activity (PA) and sedentary behaviour recommend that all adults should undertake 150-300 min of moderate-intensity, or 75-150 min of vigorous-intensity PA, per week [9]. The guidelines include also regular muscle-strengthening activities – for adults for example at least 2 days a week [9]. According to WHO, physical exercises in adult age group (18-64 years) of healthy population may help to prevent obesity, cardiovascular diseases, type 2 diabetes, cognitive disorders or lower the all-cause and cause-specific mortality [9]. There are also reports on their positive effects on mental health [9,10], including mentioning PA as an important supplement to the treatment of depression disorder [10, 11].

In the literature there are also evidences on its beneficial effect on functioning of the gastrointestinal (GI) tract. It was reported, that PA contributes to increased bowel movements and more rapid colon transit [12, 13] and, when regular, can improve defecation pattern in patients with chronic constipation [14]. Additionally, this mechanism of increased intestinal motility probably contributes to the reduction of contact between colon mucosa and potential carcinogens, making PA an independent colon cancer protecting factor [15]. These increased bowel movements also indirectly cause deterioration of secondary bile acids concentration or increase of faecal short chain fatty acids [16] and this proces may also explain the protective effect of exercises on colon cancer. In recent metanalysis regarding the association between PA and GI cancers the authors highlight, that moderate to high PA seems to reduce an overall risk of digestive-system cancer and the protection rates differ depending on the localization of the cancer in GI [17]. In addition to the previously mentioned potential explanations for this protective phenomenon, Fangfang et al. also mention improving insulin sensivity and immune anticancer function. On the other hand, too high intensity of PA, such as long runs or triathlon, can provoke diarrhoea or heartburn, but this effect is transient and does not affect the athlete’s health in the long term [15].

There are is also the relationship between the gut microbiota and PA. For example, Bressa et al. reported higher levels of some beneficial bacteria of microbiota in active woman in comparison to sedentary women [18]. To the similar conclusion came Clarke et al. in their study with rugby players, while simultaneously indicating, that the relationship between exercises and gut microbiota is complex [19]. Authors, among Clarke et.al and Mehrbod et al., also underline corelations between cardiorespiratory fitness and health-associated intestinal microbiome taxonomic richness and diversity [19, 20]. There is a report suggesting, that PA in childhood and adolescence contributes to more diverse gut microbiota [21]. On the other hand there are also reports, that physical exercises have no positive effect on gut microbiome richness [22], especially in untrained patients [23]. However, the studies examining the effect of physical activity alone on intestinal microbiota, in independence of diet, are still lacking.

**Clinical significance of physical activity in prevention and treatment of immune bowel diseases: Crohn disease, ulcerative colitis**

The beneficial effect of exercises causing boosting immune response and deterioration of pro-inflammatory cytokines is a phenomenon widely described in the literature [24]. The dysfunction of intestinal immune system, causing chronic inflammation and exaggerated immune response to gut microbiota both lead to deterioration in epithelial barrier function. This phenomenon plays an important role in multifactorial pathogenesis of IBD [25]. The prevalence of both ulcerative colitis (UC) and Crohn's disease (CD) has been observed in white collar jobs more frequently in comparison to the general population. In the study by Sonnenberg et al. conducted on a large group of German employees, it was confirmed that incidences of IBD were increased more in the group of sedentary or less physically demanding jobs than in those with high physically demanding occupation, which imply sedentary lifestyle and white collar job being a risk factor for IBD [26]. On the other hand, literature reports indicate that PA contributes only to decrease the risk of developing CD, but not UC [27, 28].

The effect of PA on course of IBD still requires more examination. Its contribution to higher quality of life and reduction of stress in patients with IBD has been already proven by Loudon et al. [29], but the large prospective trials regarding the association between exercise and disease activity are lacking. On the other hand, sedentary lifestyle contributes to development of obesity, which belongs to proven risk factor of increased rates of hospitalization, persistent disease activity, perianal complications and lower time to first surgery among the patients with IBD [30]. Furthermore, exercises should be recommended as a prevention of osteoporosis and muscle weakness, to which patients are exposed due to glicocorticosteroids, still used in inducing flare remission [15].

**Clinical significance of physical activity in prevention and treatment of irritable bowel syndrome**

The British guidelines of the National Institute for Health and Care Excellence indicate, that patient education in PA plays role both for the prevention and treatment of IBS [31]. Sadeghian et al. conducted a cross-sectional study among nearly 5,000 Iranian adults, both men and women. Their study observed that those with sedentary lifestyles had a 27% higher risk of developing IBS compared to those who were physically active [32].

American College of Gastroenterology in their monograph on management of IBS reported, that physical exercises should be recommended for overall symptoms improvement in patients with IBS, but the quality of evidence is low [33], as the number of randomised controlled trials (RCTs) exploring the benefits of exercise in IBS patients is insufficient. Daley et al. in their RCT compared a 12-week exercise intervention with usual care in 56 patients with IBS, among whom quality of life (IBS-QOL) and the Birmingahm IBS Symptom Questionnaire were assessed before and after the intervention. The study found a significant benefit of PA only for constipation, but not for other typical IBS symptoms, such as abdominal pain, diarrhoea, total symptom score or quality of life. [34]. In another study by Johanneson et al, 102 patients with IBS were randomised to a group of increased PA monitored by a physical therapist or usual care for 12 weeks. 75 patients completed the study [35]. A greater improvement in symptom severity, as measured using the IBS Severity Scoring System (IBS-SSS), was observed in the exercise group compared to the control group (P=0.003). In long-term follow-up data (median follow-up of 5.2 years) for 39 patients from a previous RCT, there was a positive long-term effect of PA on IBS symptoms and psychological symptoms [36].

| | IBS | IBD |
|---|---|---|
| **Prevention** | • Insufficient evidence.<br>• Sedentary lifestyle is suggested as a risk factor. | • Limited evidence for UC.<br>• Sedentary lifestyle has been linked to an elevated risk of IBD<br>• Stronger evidence for protective effect in CD. |
| **Course of Disease** | • Limited evidence.<br>• It is indicated for relieving constipation.<br>• Potential benefits for overall symptom management and mental health | • Limited to moderate evidence.<br>• Improves quality of life and reduces stress.<br>• May provide protection against obesity, which is associated with a worse disease course. |

**IBS** = Irritable Bowel Syndrome; **IBD** = Inflammatory Bowel Diseases; **CD** = Crohn's Disease; **UC** = Ulcerative Colitis

**Table 1.** *Summary of available research on the impact of physical activity on the prevention and course of IBS and IBD.*

## Conclusions

PA improves function of GI by increasing colon transit and bowel movements. These mechanisms contribute to reducing the risk of colorectal cancer and, to varying degrees depending on location, other digestive-system cancers. There is a potential association between PA and the more health-beneficial gut microbiota, but more research in this area is needed.

Although the multifaceted positive effects of physical activity on gastrointestinal function have been proven, its impact on the prevention and course of gastrointestinal diseases such as IBS and IBD is more complex. A sedentary lifestyle appears to be a risk factor for IBD. However, other reports indicate a protective effect of physical activity only for CD. Conclusions on the effect of PA on the course of UC and CD still require expanded research. Available literature suggests that physical activity prevents obesity, a proven risk factor for worsening the course of the disease, and osteoporosis, an important complication of glucocorticosteroid therapy. Despite evidence of a sedentary lifestyle as a risk factor for IBS, there is still a lack of studies examining the impact of physical activity as a protective factor. Likewise, the number of RCTs examining the effect of PA on the course of IBS remains insufficient, and studies conducted should take into account the various symptoms of IBS. Some authors have concluded that PA may have a beneficial effect only on constipation, but not others IBS symptoms. However, it seems that PA may contribute to improving the mental health of these patients.

**Disclosures:**

**Author's contribution:**

**Conceptualization:** Marta Kapler, Magdalena N. Mąsior
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