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THE IMPACT OF PHYSICAL ACTIVITY ON BOWEL PERISTALSIS

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ABSTRACT

Purpose: The aim of this article is to analyze the available scientific evidence regarding the impact of physical activity on intestinal peristalsis, with a particular focus on the physiological mechanisms underlying this process. The article seeks to assess the role of regular physical exercise in improving bowel motility, reducing constipation, and promoting overall gastrointestinal health, as well as understanding the potential mechanisms linking physical activity to enhanced intestinal peristalsis."

Methodology: A systematic review of RCTs and meta-analyses from PubMed (since 2015) was conducted. Studies on various PA interventions, combined diet/exercise effects, and specific populations (IBS, older adults) were included.

Findings: Meta-analyses show PA (moderate/high, aerobic) significantly reduces constipation risk (RR 1.97, 0.69) and improves symptoms. PA enhances colonic motility, reduces transit time, and modulates gut microbiota. Synergistic with diet. Benefits IBS.

Conclusions: Physical activity, especially moderate aerobic exercise, consistently benefits bowel peristalsis and alleviates constipation by improving motility, transit time, and gut microbiota. It's a valuable non-pharmacological intervention.

KEYWORDS

Physical Activity, Exercise, Bowel Peristalsis, Constipation, Gastrointestinal Motility, Gut Microbiota, Randomized Controlled Trials, Meta-analysis, Irritable Bowel Syndrome

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1. Introduction

Constipation, characterized by infrequent bowel movements (typically fewer than three per week), difficult defecation, and the sensation of incomplete evacuation, represents a common gastrointestinal disorder with significant implications for public health.¹ The global prevalence of functional constipation meeting Rome IV diagnostic criteria is estimated to be around 10.1%, highlighting its widespread occurrence (1). The underlying causes of constipation are multifaceted, often involving dysfunction of the colon, rectum, pelvic floor, and anus (1). If left unmanaged, constipation can lead to a range of complications, including more severe conditions such as fecal impaction or intestinal perforation, substantially diminishing the quality of life for affected individuals and imposing a considerable economic burden on healthcare systems (1). Certain populations, such as women and older adults, have been identified as being at a higher risk of experiencing constipation (1). Given the far-reaching consequences of this condition, identifying effective interventions is of paramount importance.

While various therapeutic strategies exist for constipation, non-pharmacological approaches, including lifestyle and dietary adjustments, biofeedback techniques, and neurostimulation, are often considered as initial management steps (1). However, the effectiveness of some of these non-pharmacological treatments may be limited or require further investigation to confirm their clinical efficacy (1). In this context, regular physical activity (PA) has emerged as a key component in the initial treatment of functional constipation (1). The World Health Organization (WHO) defines PA as any bodily movement produced by skeletal muscles that results in energy expenditure (1). Engaging in PA may not only prevent and delay the onset of various diseases but has also been shown to have a relationship with constipation, where a lack of PA may increase the duration of constipation episodes (1). Furthermore, studies have indicated a potential dose-effect relationship between the intensity of PA and its impact on constipation (1). Recognizing the potential benefits of PA as a non-pharmacological treatment for constipation, particularly its lack of side effects, sustainability, and cost-effectiveness, it is crucial to thoroughly examine the existing evidence regarding its impact on bowel function (1). This medical journal article aims to systematically review the evidence from randomized controlled trials (RCTs) and meta-analyses published on PubMed since 2015, focusing on the effects of physical activity on bowel peristalsis and the management of constipation.

2. Physiological Basis of Bowel Peristalsis and the Rationale for Physical Activity

Normal bowel peristalsis is the fundamental physiological process responsible for the movement of contents through the gastrointestinal tract (2). This process involves the rhythmic contraction and relaxation of the smooth muscles within the intestinal walls, effectively propelling food and waste products along the digestive pathway (2). This intrinsic muscle activity, known as motility, varies in its pattern and intensity depending on the specific segment of the digestive tract and the physiological state of the individual, such as whether they are in a fed or fasted state (2). For instance, shortly after food ingestion, segmentation contractions predominate, where neighboring gastrointestinal segments contract simultaneously. In contrast, during fasting periods, the migratory motor complex (MMC) occurs, a cyclical pattern of motility that moves from the stomach to the ileocecal valve over approximately 90 minutes (2). The intricate regulation of gastrointestinal motility involves a complex interplay of neurohumoral mechanisms (2).

Several hypotheses have been proposed to explain how physical activity might positively influence bowel peristalsis and alleviate constipation (1). One prominent theory suggests that physical activity stimulates colonic contractions, thereby reducing the time it takes for stool to travel through the colon (3). This accelerated colonic transit time can help to prevent excessive water reabsorption from the stool, which can lead to hardening and difficulty in passing bowel movements. Furthermore, exercise may contribute to increased blood flow to the gastrointestinal tract (1). Adequate blood supply is essential for maintaining the health and proper functioning of the intestinal muscles and other tissues involved in peristalsis. The gut microbiome, a complex community of microorganisms residing in the intestines, is increasingly recognized for its role in digestive health. Physical activity has been shown to modulate the composition and diversity of this microbial community (2). These exercise-induced changes in the gut microbiome can influence stool consistency, gas production, and overall colonic function, potentially leading to improved peristalsis. Regular physical activity also possesses anti-inflammatory properties (2). Chronic low-grade inflammation within the gut can sometimes impair motility, and the reduction of inflammation through exercise may indirectly benefit bowel function. The connection between the brain and the gut, known as the gut-brain axis, is another important consideration. Physical activity is known to improve psychological well-being and reduce stress levels (6), which can have a positive impact on gut motility and function, potentially alleviating stress-related constipation. Additionally,

certain types of physical activity can strengthen the abdominal muscles and increase intra-abdominal pressure, which may aid in the process of defecation (8). The multifaceted nature of these potential mechanisms suggests that physical activity can influence bowel function through a variety of interconnected physiological pathways.

It is important to note that the impact of physical activity on bowel peristalsis may not be uniform across different types and intensities of exercise (1). Some evidence suggests that light to moderate intensity physical activity, particularly for durations of less than 60 minutes, may be generally beneficial for enhancing colonic motility (5). However, prolonged or high-intensity exercise could potentially have different, or even inhibitory, effects on gastrointestinal motility in some individuals (5). This complexity underscores the need to carefully examine the specific characteristics of the physical activity interventions investigated in the reviewed studies to better understand the nuances of this relationship.

3. Evidence from Meta-Analyses on Physical Activity and Constipation

A meta-analysis conducted by Gao et al. in 2019 aimed to analyze the effects of exercise on constipation by systematically reviewing and pooling data from randomized controlled trials (10). The researchers conducted a comprehensive search across several major databases, including PubMed, Web of Science, EMBASE, Cochrane Library, and three Chinese databases, for studies published up to June 2018 (20). The meta-analysis included a total of nine randomized controlled trials involving 680 participants (10). The key finding of this analysis was that exercise therapy demonstrated significant benefits in improving the symptoms of constipation in patients, with a relative risk (RR) of 1.97 (95% confidence interval [CI]: 1.19, 3.27; $p = 0.009$; $I^2=91.3\%$) (10). Subgroup analysis revealed that aerobic exercise, which included activities such as Qigong, walking, and general physical movement, also had a positive effect on constipation (RR = 2.42; 95% CI: 1.34, 4.36; $p = 0.000$; $I^2=88\%$) (10). The authors concluded that while exercise appears to be a feasible and effective treatment option for patients with constipation, these findings were associated with a high risk of bias due to methodological shortcomings identified in the included studies. This necessitates further research with more rigorous designs to definitively determine the true effect of exercise on constipation (10). The results of this meta-analysis suggest an overall positive association between exercise and the improvement of constipation symptoms, particularly with aerobic forms of exercise. However, the acknowledged risk of bias highlights the importance of interpreting these findings with caution and underscores the need for future well-designed studies.

Another meta-analysis, the details of which are further elucidated in the discussion of a systematic review (1), specifically examined the relationship between physical activity and constipation across different levels of PA and adherence to international PA guidelines. This review aimed to determine if PA could reduce constipation risk and the effect of varying PA levels on this risk (1). The methodology involved a random-effects meta-analysis that compared high versus low PA, high versus moderate PA, and moderate versus low PA, as well as individuals meeting versus not meeting international PA guidelines (1). The findings indicated that PA serves as a protective factor against constipation. When compared to low levels of physical activity, both moderate PA (RR = 0.85; 95% CI = 0.72–1.00) and high PA (RR = 0.69; 95% CI = 0.58–0.83) were associated with a reduced risk of constipation (1). Furthermore, the analysis showed that high PA was associated with a 13% decrease in constipation risk when compared to moderate PA (1). The authors concluded that these results demonstrate that PA is an effective means to alleviate symptoms of constipation (1). This meta-analysis provides a more nuanced understanding of the relationship between physical activity and constipation by demonstrating a potential dose-response effect, where higher levels of PA are associated with a greater reduction in constipation risk. The consistency of these findings with a previous meta-analysis further strengthens the evidence supporting the beneficial role of PA in managing constipation (1).

4. Findings from Randomized Controlled Trials on Specific Physical Activity Interventions

The meta-analysis by Gao et al. (2019) included several randomized controlled trials that investigated the effects of specific aerobic exercises on constipation symptoms (10). These trials, focusing on interventions such as Qigong, walking, and general physical movement, collectively showed positive outcomes in alleviating constipation (10). This consistency across different forms of aerobic activity suggests that the key factor might be the engagement in regular exercise that elevates heart rate and breathing, rather than the specific modality chosen.

Several studies have examined the combined effects of diet and exercise on constipation (4). A study on nurses' health, while not an RCT, found that women who increased their dietary fiber intake and participated in moderate physical activity were less likely to experience constipation (RR = 0.32; 95% CI: 0.20-0.54) (4).

This suggests a potential synergistic benefit when both dietary and physical activity modifications are implemented. An analysis of data from the National Health and Nutrition Examination Survey (NHANES) 2007-2010 revealed that a healthy diet, characterized by a high Healthy Eating Index (HEI), combined with high levels of physical activity (≥ 500 MET-min/wk) was effective in improving chronic constipation, regardless of whether constipation was defined by stool consistency or stool frequency (4). Interestingly, the effect of a healthy diet alone was not statistically significant at lower levels of physical activity, indicating that sufficient physical activity may be necessary to maximize the benefits of dietary improvements for constipation. Furthermore, higher HEI-2015 scores were associated with a reduced risk of constipation in individuals with high physical activity levels but not in those with low levels, further supporting the idea of a synergistic interaction (11). These findings underscore the importance of considering both diet and physical activity when developing interventions for constipation.

Physical activity has also been investigated as a management strategy for constipation in specific populations, such as individuals with Irritable Bowel Syndrome (IBS) (10). A 12-week moderate-intensity exercise intervention in patients with IBS resulted in a significant (33%) reduction in constipation symptoms compared to a control group (5). A randomized controlled trial by Daley et al. (referenced in (3)) demonstrated that physical activity could significantly improve symptom relief in IBS patients, including a reduction in constipation (12). Controlled studies conducted in Sweden (referenced in (12)) found that moderate to high-intensity physical activity (like walking, cycling, aerobics) performed three to five times a week for 20 to 60 minutes had beneficial effects on gastrointestinal symptoms, including bowel function (12). A study by Johannesson et al. (reported that increased physical activity, such as walking and cycling, was associated with long-term improvement in symptoms like bloating and postprandial fullness in IBS patients (3). While a meta-analysis of six RCTs assessing physical activity for global IBS symptoms showed improvement, the certainty of this evidence was low (13). These findings suggest that physical activity can play a beneficial role in managing constipation associated with IBS, although further research is needed to optimize exercise recommendations for this heterogeneous population. In the context of postoperative recovery from colorectal cancer, one study found no significant association between exercise habits and defecatory dysfunction, including constipation, but did observe an association between dietary fiber intake and frequent stools (9). This suggests that in this specific clinical context, dietary interventions might be particularly important, although the broader benefits of exercise for gastrointestinal health are still relevant.

5. The Interplay of Physical Activity with Diet and Other Lifestyle Factors

As highlighted by several studies, the benefits of a healthy diet, particularly one rich in dietary fiber, on constipation appear to be amplified by the presence of regular physical activity (4). This synergistic effect suggests that recommending both dietary modifications and increased physical activity levels is a more effective strategy for managing constipation than focusing on either aspect in isolation. The evidence indicates that physical activity may enhance the positive impact of dietary fiber on improving stool consistency and increasing bowel movement frequency.

Adequate fluid intake is another crucial lifestyle factor that plays a significant role in maintaining optimal bowel function, especially when dietary fiber intake is increased (4). Fiber absorbs water, and insufficient fluid intake can lead to constipation rather than alleviating it. One study found an association between lower daily fluid intake (less than 1 liter) and constipation (9). Therefore, while the primary focus of this review is on physical activity, it is important to acknowledge that adequate hydration is an essential component of a comprehensive lifestyle approach to preventing and managing constipation.

6. Impact of Physical Activity on Gastrointestinal Transit Time and Gut Microbiota

Several studies have investigated the effects of physical activity on gastrointestinal transit time, a direct measure of bowel motility (3). The general consensus from the reviewed literature is that aerobic exercise can enhance colonic motility and accelerate the transit of food and waste through the gastrointestinal tract (3). This acceleration of transit time is a key mechanism by which physical activity can help to alleviate constipation, as it reduces the time available for water to be reabsorbed from the stool, thus preventing it from becoming hard and difficult to pass. A study utilizing accelerometry to objectively measure physical activity levels found that spending more time engaged in high light intensity physical activity was associated with a more rapid colonic and whole gut transit time, and this association was independent of factors such as age, sex, and body fat (7). This provides strong evidence linking habitual physical activity levels to the speed at which contents move through the digestive system. However, it has also been noted that the effects of exercise on

gastrointestinal motility might depend on the intensity and duration of the activity. Some studies suggest that while light to moderate physical activity (less than 60 minutes) is generally beneficial, prolonged or high-intensity exercise could potentially have inhibitory effects on motility in some individuals (5). This highlights the complex nature of the relationship and suggests that exercise recommendations might need to consider these factors. Interestingly, a study conducted on rats found that voluntary exercise did not lead to an increase in overall gastrointestinal motility (26), indicating that findings from animal models might not always directly translate to human physiology.

The gut microbiota, a vast and diverse community of microorganisms residing in the intestines, is increasingly recognized for its crucial role in human health, including its influence on gastrointestinal function (2). Physical activity has been shown to induce changes in the composition and diversity of the gut microbiome (2). Regular moderate exercise has been associated with beneficial alterations in the gut microbiota, including an increase in the abundance of beneficial bacteria such as *Lactobacillus* and *Bifidobacterium* (2). Aerobic exercises, like running, swimming, and cycling, have been particularly effective in enhancing microbial diversity and promoting the growth of these beneficial bacterial species (6). These exercise-induced changes in the gut microbiome can have a positive impact on gut health and motility, potentially contributing to the alleviation of constipation. For instance, an increase in the production of short-chain fatty acids (SCFAs) by the gut microbiota, which can be influenced by exercise, has anti-inflammatory properties and can strengthen the intestinal barrier (6). The modulation of the gut microbiota by physical activity represents another important pathway through which exercise can exert its beneficial effects on bowel function.

7. Considerations for Specific Populations and Exercise Recommendations

Older adults are a population group that is particularly susceptible to constipation (1). While some studies investigating the effect of physical activity on constipation in the elderly have not shown a direct improvement in the frequency of bowel movements, exercise has been associated with an enhanced quality of life in this population (8). Given the increased risk of fecal impaction in older adults with low physical activity levels (10), encouraging regular, safe, and feasible physical activity, such as walking, is important for their overall well-being and may indirectly benefit bowel function.

For individuals with Irritable Bowel Syndrome (IBS), particularly those experiencing constipation-predominant IBS (IBS-C), moderate-intensity aerobic exercise is often recommended as part of a comprehensive management plan (7). Typical recommendations include engaging in 30 to 60 minutes of moderate-intensity aerobic activity for 3 to 5 days per week (7). Physical activity has been shown to be associated with a reduction in the overall severity of IBS symptoms and an improvement in quality of life (2). Specifically, some studies have indicated that physical activity can help to alleviate constipation, a common and bothersome symptom in IBS (3). Therefore, exercise should be considered as an integral component of managing IBS-related constipation, alongside dietary modifications and other therapeutic approaches, tailored to the individual's tolerance and specific symptom triggers.

General health guidelines typically recommend that adults engage in at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity each week to achieve substantial health benefits (1). When specifically considering the improvement of bowel peristalsis and the alleviation of constipation, moderate-intensity aerobic exercises, such as brisk walking, cycling, or swimming, performed for at least 30 minutes on most days of the week, may be particularly beneficial (5). Notably, the recommendation to use physical activity, such as walking, as a strategy to address constipation is considered to be an efficient and inexpensive approach that is accessible to individuals across various socioeconomic statuses (8). While more specific and individualized exercise recommendations may require further research, encouraging adherence to these general physical activity guidelines represents a reasonable and evidence-based starting point for improving bowel health and potentially preventing or managing constipation.

8. Conclusions

The evidence reviewed in this article consistently supports the beneficial impact of physical activity, particularly moderate-intensity aerobic exercise, on bowel peristalsis and the alleviation of constipation. Meta-analyses and randomized controlled trials published since 2015 indicate that regular physical activity can improve gastrointestinal motility, reduce transit time, and positively modulate the gut microbiota, all of which contribute to healthier bowel function. Furthermore, the combination of physical activity with a healthy, high-fiber diet and adequate fluid intake appears to have a synergistic effect in managing constipation.

Despite these promising findings, some limitations exist in the current body of evidence. Certain meta-analyses have identified a risk of bias in the included studies, and there is variability in the types of exercise interventions and outcome measures used across different trials. More research is needed to refine exercise recommendations for specific populations, such as older adults and individuals with IBS, and to fully understand the optimal type, intensity, duration, and frequency of physical activity for addressing constipation. Future research should focus on conducting well-designed RCTs with standardized protocols and clear, constipation-specific outcomes, as well as investigating the long-term effects of physical activity interventions.

Nevertheless, the current evidence strongly suggests that physical activity should be considered a valuable non-pharmacological intervention for both the prevention and management of constipation. Healthcare professionals should encourage and recommend regular physical activity as part of a holistic approach to bowel health, tailoring advice to individual patient needs, preferences, and physical capabilities. Promoting an active lifestyle, alongside dietary modifications and adequate hydration, holds significant potential for improving bowel function and enhancing the quality of life for individuals experiencing constipation.

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