Physical Activity, Sitting, Quality of Life, and Resilience in Inflammatory Bowel Disease

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ABSTRACT

Background: Inflammatory bowel diseases (IBD) are a group of autoimmune diseases characterized by the cyclical nature of flare and remission periods that can affect health-related quality of life (HRQOL). Physical activity can benefit HRQOL in the general population and in individuals with chronic diseases. However, there is a paucity of data on physical activity and HRQOL in IBD. The purpose was to characterize physical activity, sitting, HRQOL, and resilience levels in people with IBD (in remission and disease flare) compared with healthy controls.

Methods: Participants with IBD (n=242; 96 in disease flare and 146 in disease remission) and healthy controls (n=265) reported levels of physical activity, sitting, HRQOL, and resilience. Data were analyzed using analysis of covariance, with demographic variables as covariates.

Results: IBD participants reported lower physical activity and resilience than controls (P<0.05) with no differences between disease states. Time spent sitting was not different across groups (P=0.07). There were lower scores of physical and mental HRQOL in people with IBD (44.2±9.7 and 40.7±11.7, respectively) than controls (55.9±6.0 and 48.1±10.0, respectively; P<0.001).

Conclusion: Our findings suggest that people with IBD have lower levels of physical activity, HRQOL, and resilience than healthy controls but no difference in time spent sitting. There were no apparent negative consequences of a disease flare on physical activity and resilience levels; however, those in a flare reported reduced HRQOL. Research should begin to focus on physical activity or mental skills training interventions for improving HRQOL in people with IBD, particularly those in a disease flare. Journal of Clinical Exercise Physiology. 2019;8(4):121–130.

Keywords: Crohn's disease, ulcerative colitis, sedentary behavior, moderate-to-vigorous physical activity

INTRODUCTION

It is recognized that there are considerable benefits, including but not limited to improved cardiometabolic risk factors (1), improved mood (2), and enhanced overall health (3), associated with regular participation in physical activity, particularly moderate-to-vigorous physical activity (MVPA). Research shows that physical activity may be beneficial for a myriad of chronic diseases, such as cardiometabolic disease (4), colorectal cancer (5), multiple sclerosis (6), and a range of other diseases (7). Physical activity is known to improve physical and mental well-being, including quality of life (8), anxiety, and depression (9), through several mechanisms including
enhanced cardiorespiratory fitness (10) and decreased inflammation (11). Despite the benefits of physical activity, many chronic disease populations report lower physical activity levels (12–15) than the general population and often do not meet the public health guidelines of 150 min·wk⁻¹ of MVPA (16).

Although the body of research on physical activity and chronic disease is growing, limited research exists regarding the prevalence and benefit of physical activity in people with inflammatory bowel diseases (IBD) such as Crohn’s disease and ulcerative colitis. IBD is a group of autoimmune diseases that affect the gastrointestinal tract and display an array of debilitating symptoms including weight loss, gastrointestinal bleeding, and abdominal pain (17). IBD is often diagnosed between the ages of 15 and 30 years (17) and occurs in a cyclical manner with periods of disease flare and remission, with many patients experiencing disease flares at least every few months (18). Because of the symptoms associated with the disease and its cyclical nature, many people with IBD report a lower health-related quality of life (HRQOL) compared to healthy populations (19). Research suggests that lower intensities of physical activity, particularly walking, are safe (20,21), tolerated (22), and benefit HRQOL in people with IBD (23), yet many physicians are hesitant to recommend physical activity to IBD patients because of fears of symptom exacerbation (24). There is currently a paucity of data on physical activity in this chronic disease population, and little is known about levels of physical activity between disease states (i.e., disease flare and remission) in comparison to healthy individuals.

In addition to investigating the beneficial effects of physical activity in chronic diseases, there is a growing interest in understanding the deleterious effects of sedentary behavior on chronic disease outcomes such as HRQOL. Sedentary behavior is defined as “any waking behavior characterized by an energy expenditure ≤ 1.5 metabolic equivalents (METs) while in a sitting or reclining posture” (25). The effects of sedentary behavior on health outcomes in disease populations has been shown to be independent of MVPA, highlighting the importance of quantifying levels of sedentary behavior in these groups. For example, sedentary behavior is negatively associated with HRQOL in people with congestive heart failure, independent of MVPA (26). Further, research indicates that people with colorectal cancer engage in high levels of sedentary behavior (27) with prolonged sedentary time associated with a lower HRQOL (28). To date there is no research comparing time spent in sedentary behaviors in different disease states of IBD and healthy individuals. Understanding these differences may provide important information for lifestyle interventions that aim to reduce sedentary time.

Researchers are investigating the positive relationship between HRQOL and resilience in the general population (29,30). Resilience is described as “a quality that enables a person to thrive in the face of adversity” (31) and is often referred to as a measure of coping ability. Research shows resilience in the general population is associated with favorable mental health outcomes (32), positive self-ratings of physical health and symptoms (33), and HRQOL (34).

Research regarding the role of resilience in chronic disease populations indicates that individuals with chronic diseases tend to have lower resilience levels than those without disease (35). Findings show resilience is positively associated with health and improved treatment outcomes in people with cancer (36), human immunodeficiency virus (33), Parkinson’s disease (37), and diabetes (38). For example, hemoglobin A1c levels were lower in people with type 2 diabetes who had higher levels of resilience compared to those with lower levels of resilience (39). These findings suggest that resilience may be associated with improved health outcomes in chronic disease populations.

Although there is evidence to suggest a positive role of resilience in people with chronic disease, there is limited research on the role of resilience in people with IBD. Recent prospective findings on the association between resilience and risk of IBD in men indicate lower levels of resilience are associated with a greater disease risk (40). Data reported on participants with irritable bowel syndrome, a disease with similar symptomology but different pathology to IBD, are to date descriptive only and indicate low levels of resilience in this group (41–43). It is difficult to draw direct comparisons between people with irritable bowel syndrome and those with IBD as previous research shows that those with irritable bowel syndrome are more likely to catastrophize their symptoms and report lower HRQOL in comparison to people with IBD (44).

Recent research by Sirois and Hirsch (45) found that people with IBD who had higher levels of resilience also had improved coping strategies, higher levels of illness acceptance and social support, as well as lower ratings of depression symptoms. This suggests that resilience may be beneficial for coping with IBD by associated improvements in illness acceptance and mental health. Increased resilience is a positive psychosocial trait in individuals with chronic diseases such as diabetes (38) and initial research indicates similar findings in people with IBD (45). However, Sirois and Hersch (45) did not compare people with IBD to healthy controls, nor did they investigate differences in resilience between those with IBD in a disease flare compared to remission. This type of information may offer further insight about the role of resilience in people with IBD. Therefore, the current study aimed to characterize and compare physical activity, sitting, HRQOL, and resilience levels in people with IBD (i.e., in remission and disease flare) and healthy controls. It was hypothesized that there would be no differences in physical activity or sitting among the groups but HRQOL and resilience levels would be significantly lower in people with IBD compared to healthy controls. It was further hypothesized that people with IBD who were currently in a disease flare would report lower HRQOL, physical activity levels, and resilience, as well as higher levels of sitting compared to individuals in disease remission.
METHODS

Study Participants

Participants, aged 18 to 65 years, who had a self-reported diagnosis of IBD or who were considered healthy were recruited to complete an online survey. The online survey, delivered through Qualtrics survey software (Qualtrics LLC, Provo, Utah), included questions from the International Physical Activity Questionnaire short version, the Short Form-36, and the Connor-Davidson Resilience Scale, and took approximately 10 to 15 min to complete. IBD participants were recruited through online social networking sites for those with the disease and through ResearchMatch. Healthy controls were recruited through word-of-mouth, academic institutions, and ResearchMatch. ResearchMatch is a national health volunteer registry that was created by several academic institutions and supported by the US National Institutes of Health as part of the Clinical Translational Science Award Program. ResearchMatch has a large population of volunteers who have consented to be contacted by researchers about health studies for which they may be eligible.

Of the 793 participants who began the survey, 328 participants with self-reported IBD and 318 healthy controls were enrolled in the study as described in Figure 1. The study was certified exempt by the University of Idaho Institutional Review Board and all participants provided informed consent prior to data collection.

Instrumentation

Physical activity and time spent sitting were measured using the International Physical Activity Questionnaire short version. The survey is comprised of 7 items that measure physical activity at various intensities and sedentary behavior: (i) vigorous-intensity activity, (ii) moderate-intensity activity, (iii) walking, and (iv) sitting. The International Physical Activity Questionnaire is the most widely used physical activity assessment questionnaire (46) and is shown to be reliable (47) and equally as valid as other established self-report physical activity instruments in adult populations (48).

HRQOL was measured with the Short Form-36 (SF-36) previously designed to assess functional status, wellbeing, and general perceptions of health. The SF-36 is a generic, multidimensional instrument that consists of 36 questions representing 8 subscales: physical functioning, bodily pain, vitality, social functioning, mental health, general health, role limitations due to physical problems, and role limitations due to emotional issues. Scores from the instrument range from 0 to 100 with higher scores indicating higher levels of HRQOL. The SF-36 has been validated and shown to be reliable in the general population (49) and in people with IBD (19).

The 10-item Connor-Davidson Resilience Scale, a single construct instrument, was used to assess resilience as it has been shown to be a more valid instrument that the original 25-item instrument, due to an improved factor structure,
in both the general population (50) and IBD participants (unpublished data). Questions include items such as “ability to adapt to change” and “not easily discouraged by failure.” Responses are measured on a 5-point Likert scale with scores ranging from 0 to 40 and higher scores signifying higher levels of resilience.

Demographic information included age, sex, smoking habits, and education status. These basic demographic variables were in addition to IBD-specific questions such as the number of years diagnosed with the disease (i.e., disease history), the specific diagnosis of IBD (i.e., Crohn’s disease versus ulcerative colitis), and participant’s self-reported disease state at the time of the survey (i.e., disease flare or remission).

Statistical Analyses
Data were initially screened for missing data, normality, and outliers. Data cleaning identified 86 responses from IBD participants and 53 responses from healthy controls that were missing data and overall scores for at least 2 instruments; these cases were removed from the data set (Figure 1). Physical activity variables, in both minutes per week and MET-minutes per week, were non-normally distributed and were square root transformed for all analyses. Non-transformed data are presented in the results section for ease of interpretation.

Data were further analyzed for univariate and multivariate outliers using z-scores and Mahalanobis distance, respectively. Seven cases were removed from the analysis with outliers with z-scores greater than 3.3 and/or Mahalanobis distance scores that were significant at \( P < 0.01 \) (51). Final sample sizes included data from 242 IBD participants (i.e., 96 IBD participants in a disease flare [IBD-flare] and 146 IBD participants in disease remission [IBD-remission]) and 265 healthy controls.

Data are reported as mean and standard deviations (mean ± SD) unless otherwise stated. Data were initially analyzed to determine whether there were any differences in physical activity, sitting, resilience, or HRQOL between disease diagnoses (i.e., Crohn’s disease and ulcerative colitis); however, no differences were found so data were analyzed together. Analysis of covariance tests with Bonferroni pairwise comparisons were used to compare IBD-flare, IBD-remission, and healthy controls on physical activity, sitting, HRQOL, and resilience. Age, sex, disease history, smoking status, and education level were used as covariates. These variables were used as covariates in the analysis because of their role in physical activity participation and HRQOL (52). Further, age, disease history, and smoking status differed across groups and were controlled for in the analyses. All analyses were conducted using SPSS v24.0 (IBM Corporation, Armonk, New York) with an alpha level set at 0.05.

RESULTS
Participant Characteristics
Participants self-reported to be free from any cardiovascular, pulmonary, or metabolic disease, and IBD (healthy controls), or that they had a physician diagnosis of IBD (IBD participants) who were then subdivided based on their self-reported disease state (i.e., disease flare versus remission). IBD participants were also free of any cardiovascular, pulmonary, and metabolic diseases; however, they were not asked about extraintestinal manifestations, such as osteoporosis or other autoimmune diseases. All participant characteristics are displayed in Table 1. Groups differed on age, smoking status, and disease history duration; therefore, these variables were used as covariates in all analyses.

IBD participants were predominantly female (80.2%) with an average age of 39.6 years. Of the people with IBD, 96 reported to have Crohn’s disease, 145 had ulcerative colitis, and 1 participant reported having both diseases. IBD participants self-reported an average of 11.9 years since their diagnosis, with IBD-remission participants reporting a longer disease diagnosis of IBD (13.1 ± 12.4 years) compared to IBD-flare participants (9.9 ± 10.3 years). Overall, 45% of people with IBD self-reported meeting the physical activity guidelines of 150 min·wk^-1 for health (16). When groups were divided into IBD-flare and IBD-remission, 42% (n = 40) of the IBD-flare group met physical activity recommendations compared to 48% (n = 70) of people in disease remission. Participants with IBD also reported spending approximately 7 h sitting on a typical weekday (424 ± 196 min·d^-1).

Healthy controls (n = 265) were also predominantly female (75.9%) with an average age of 36.5 years, which was significantly lower than that of the IBD participants (39.6 ± 14.3 years, \( P < 0.001 \)). Of the healthy control participants, 73% (n = 193) met the current physical activity recommendations for health. Healthy controls spent approximately 6.5 h sitting on a typical weekday (395 ± 182 min·d^-1). Interestingly, healthy controls had a lower prevalence of ex-smokers (14.0%) and current-smokers (4.9%) in comparison to people with IBD (34.3% and 9.9%, respectively).

Differences in HRQOL Across Groups
There was a significant main effect for physical HRQOL across the 3 groups \((P < 0.001, \eta^2 = 0.31)\), with IBD-flare participants reporting the lowest levels of physical HRQOL (38.9 ± 8.3). IBD-flare participants had significantly lower physical HRQOL than both IBD-remission participants and healthy controls \((P < 0.001 \) for both). Additionally, IBD-remission participants \((47.6 ± 9.4)\) reported significantly lower levels of physical HRQOL than healthy controls \((55.9 ± 6.0; P < 0.001\)). The largest difference, on average, between groups was in general health perceptions, with IBD-flare \((33.3 ± 9.4)\) scoring more than 20 points lower than healthy controls \((54.4 ± 8.7)\), although no statistical tests were conducted.

There was a significant main effect for mental HRQOL across the 3 groups \((P < 0.001, \eta^2 = 0.13)\) with IBD-flare participants reporting the lowest levels of mental HRQOL compared to IBD-remission \((P < 0.001)\) and healthy controls \((P < 0.001)\). The IBD-remission group reported significantly lower mental HRQOL than healthy controls \((P < 0.001)\). The largest difference in the mental HRQOL subscales was found
in social functioning, with IBD-flare participants (33.4 ± 10.5) reporting considerably lower scores than healthy controls (51.5 ± 8.5).

Differences in Physical Activity and Sitting Across Groups

All data and results for differences across groups for physical activity, sitting, HRQOL, and resilience are shown in Table 2. Self-reported time spent sitting on a typical weekday was not different among groups (P = 0.07, η² = 0.01), with IBD-flare participants reporting sitting on average 53 min·d⁻¹ more than healthy controls and approximately 45 min·d⁻¹ more than IBD-remission.

There was a significant main effect for walking across the 3 groups (P = 0.032, η² = 0.02) with pairwise comparisons identifying that IBD-flare participants engaged in lower volumes of walking than healthy controls (P = 0.026). On average, IBD-flare participants (301.1 ± 466.4 min·wk⁻¹) reported walking 175 min·wk⁻¹ less than healthy controls (476.5 ± 535.8 min·wk⁻¹). There were no differences for walking between IBD-flare and IBD-remission participants (P = 0.443), nor differences between IBD-remission participants and healthy controls (P = 0.572).

Moderate-intensity physical activity showed a significant main effect across the 3 groups (P = 0.003, η² = 0.03) with IBD-flare (P = 0.003) and IBD-remission (P = 0.028) participants reporting less moderate-intensity physical activity than healthy controls. Healthy controls reported engaging in higher levels of moderate-intensity physical activity with the greatest difference between IBD-flare and healthy controls (130.6 min·wk⁻¹); however, there were no differences between IBD-flare and IBD-remission participants.

There was also a significant main effect for vigorous-intensity physical activity across groups (P < 0.001, η² = 0.05). There were no differences between IBD-flare (90.5 ± 195.7 min·wk⁻¹) and IBD-remission (116.7 ± 190.4 min·wk⁻¹) participants; however, both groups reported lower vigorous-intensity physical activity than healthy controls (P < 0.001 for both).

For both, the volume of MVPA (minutes per week) and the energy cost associated with MVPA (MET-minutes per week), there was a significant main effect across groups (P < 0.001, η² ≥ 0.04 for both). Healthy controls reported higher levels of MVPA (minutes per week and MET-minutes per week) than both IBD-flare and IBD-remission participants (P < 0.001 for both). There were no differences between IBD-flare and IBD-remission participants (P > 0.05). Additionally, on average IBD-flare participants expended the least amount of energy through MVPA with more than a 1,500 MET-min·wk⁻¹ difference between IBD-flare and healthy control participants.

Differences in Resilience Across Groups

There was a significant main effect across groups (P < 0.001, η² = 0.04) for resilience scores. IBD-flare participants (P < 0.001) and IBD-remission participants (P = 0.006) reported significantly lower resilience scores than healthy controls. However, there were no differences between the 2 IBD groups (P = 0.461).
The aim of the current study was to characterize and compare physical activity, sitting, HRQOL, and resilience levels in people with IBD (i.e., in remission and disease flare) and healthy controls. It was hypothesized that there would be no differences in physical activity and sitting across groups but that HRQOL and resilience levels would be lower in the IBD participants compared to healthy controls. Furthermore, it was hypothesized IBD-remission would score higher on HRQOL and resilience than those in a disease flare.

Both groups of IBD participants reported lower levels of physical and mental HRQOL than healthy controls, which supports previous findings in this area (18,53). Importantly, the effect sizes for differences in HRQOL were moderate to large, indicating meaningful differences in HRQOL between groups. Further, analyses showed that physical and mental HRQOL were significantly lower in IBD participants in a disease flare than those in remission. These results correspond with reports from other research in the area (19,54–58) and suggest that a disease flare may negatively impact HRQOL in people with IBD. Our results suggest that general health perceptions for physical HRQOL and social functioning scores for mental HRQOL had the greatest differences compared to healthy control participants. IBD is known to impact many aspects of a person’s health, particularly gastrointestinal health, but it can also lead to extraintestinal issues such as fatigue, anemia, and bone mineral loss (59). Many of these extraintestinal issues can impact a person’s physical HRQOL and their perception of their general health. Survey research also shows that people with IBD are concerned with social aspects of the disease such as losing control of bowel movements, producing unpleasant smells, feeling dirty, and experiencing issues with sexual relationships (60). This research supports our findings in the decreased scores for the social functioning aspects of mental

<table>
<thead>
<tr>
<th>Variable</th>
<th>All IBD Participants</th>
<th>IBD-Remission</th>
<th>IBD-Flare</th>
<th>Healthy Controls</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resilience</td>
<td>27.0 ± 6.5</td>
<td>27.6 ± 6.7</td>
<td>26.1 ± 6.0</td>
<td>29.8 ± 5.5&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>&lt;0.001</td>
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<tr>
<td>HRQOL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical functioning composite score</td>
<td>44.2 ± 9.7</td>
<td>47.6 ± 9.4</td>
<td>38.9 ± 8.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>55.9 ± 6.0&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Physical functioning</td>
<td>48.2 ± 9.1</td>
<td>50.5 ± 8.4</td>
<td>44.6 ± 9.3</td>
<td>55.1 ± 4.7</td>
<td>-</td>
</tr>
<tr>
<td>Role limitation due to physical health</td>
<td>42.4 ± 10.9</td>
<td>46.5 ± 10.0</td>
<td>36.1 ± 9.7</td>
<td>54.3 ± 5.3</td>
<td>-</td>
</tr>
<tr>
<td>Bodily pain</td>
<td>43.6 ± 9.8</td>
<td>47.5 ± 9.1</td>
<td>37.4 ± 7.9</td>
<td>52.8 ± 7.1</td>
<td>-</td>
</tr>
<tr>
<td>General health perceptions</td>
<td>37.7 ± 11.2</td>
<td>40.8 ± 11.4</td>
<td>33.3 ± 9.4</td>
<td>54.4 ± 8.7</td>
<td>-</td>
</tr>
<tr>
<td>Mental functioning composite score</td>
<td>40.7 ± 11.7</td>
<td>43.6 ± 11.0</td>
<td>36.4 ± 11.6&lt;sup&gt;a&lt;/sup&gt;</td>
<td>48.1 ± 10.0&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Vitality</td>
<td>40.3 ± 11.3</td>
<td>43.6 ± 11.5</td>
<td>35.5 ± 9.5</td>
<td>51.0 ± 9.2</td>
<td>-</td>
</tr>
<tr>
<td>Social functioning</td>
<td>40.2 ± 11.7</td>
<td>44.5 ± 10.7</td>
<td>33.4 ± 10.5</td>
<td>51.5 ± 8.5</td>
<td>-</td>
</tr>
<tr>
<td>Role limitation due to emotional problems</td>
<td>42.1 ± 12.3</td>
<td>45.1 ± 11.1</td>
<td>37.8 ± 12.9</td>
<td>49.1 ± 8.6</td>
<td>-</td>
</tr>
<tr>
<td>Mental health</td>
<td>43.5 ± 10.9</td>
<td>46.0 ± 10.0</td>
<td>40.0 ± 11.2</td>
<td>49.7 ± 8.8</td>
<td>-</td>
</tr>
<tr>
<td>Physical activity &amp; sitting time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking, min·wk&lt;sup&gt;−1&lt;/sup&gt;</td>
<td>328.6 ± 421.8</td>
<td>334.5 ± 368.0</td>
<td>301.1 ± 466.4</td>
<td>476.5 ± 535.8&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>0.032</td>
</tr>
<tr>
<td>Moderate, min·wk&lt;sup&gt;−1&lt;/sup&gt;</td>
<td>173.0 ± 304.4</td>
<td>214.0 ± 363.1</td>
<td>137.2 ± 210.8</td>
<td>267.8 ± 370.5&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>0.003</td>
</tr>
<tr>
<td>Vigorous, min·wk&lt;sup&gt;−1&lt;/sup&gt;</td>
<td>105.5 ± 186.9</td>
<td>115.9 ± 189.0</td>
<td>89.5 ± 194.9</td>
<td>213.5 ± 261.8&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MVPA, min·wk&lt;sup&gt;−1&lt;/sup&gt;</td>
<td>278.5 ± 411.7</td>
<td>329.9 ± 481.2</td>
<td>226.7 ± 315.4</td>
<td>481.3 ± 528.9&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MVPA, MET-min·wk&lt;sup&gt;−1&lt;/sup&gt;</td>
<td>1,536.1 ± 2,712.4</td>
<td>1,783.0 ± 2,540.8</td>
<td>1,265.0 ± 1,920.3</td>
<td>2,779.3 ± 2,991.5&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sitting, min·d&lt;sup&gt;−1&lt;/sup&gt;</td>
<td>423.7 ± 195.7</td>
<td>403.6 ± 191.5</td>
<td>447.6 ± 195.0</td>
<td>394.5 ± 182.3</td>
<td>0.071</td>
</tr>
</tbody>
</table>

IBD = inflammatory bowel disease; HRQOL = health-related quality of life; MVPA = moderate-to-vigorous physical activity; MET = metabolic equivalent. Data presented as mean ± SD<sup>a</sup>significantly different than IBD-remission (<0.05)<sup>b</sup>significantly different than IBD-flare (<0.05)
HRQOL for people with IBD, suggesting that there are not only physical consequences of the disease, but that it also impacts a patient’s mental and social well-being.

Research suggests that physical activity may be beneficial to the IBD population, particularly in terms of improving HRQOL (61,62), a finding also noted in other chronic diseases (4–7,63). However, previous studies investigating IBD and physical activity have been limited by small sample sizes (21,24), and the prevalence of regular physical activity in people with IBD, particularly across disease states, is not well understood. The current study shows that levels of light (i.e., walking), moderate, and vigorous physical activity are lower in people with IBD compared to healthy controls. Our data indicate that healthy controls engage in over 160 min·wk$^{-1}$ more MVPA than IBD participants in disease remission. Walking showed the least difference between healthy controls and IBD-remission with less than 150 min·wk$^{-1}$ difference between these two groups. Both groups of IBD participants were lower on all aspects of physical activity than the control participants; yet IBD-flare and IBD-remission participants were not different from one another. Although those in a disease flare reported less physical activity than those in remission, this difference was not statistically significant.

These findings suggest that disease flares may not significantly impact physical activity levels in this population and that people with IBD are able to continue some level of physical activity despite the cyclical nature of the disease. This is inconsistent with previous research, which suggests that more than 75% of people with IBD report reduced leisure activities due to disease activity (64). Ghosh and Mitchell (64) asked participants, “How do your symptoms affect your ability to enjoy leisure activities (e.g., travel, dining, sports)?” This question is inclusive of leisure activities that do not necessarily involve physical activity and also queries the level of enjoyment experienced, which may partially explain the difference in findings. Although data on the benefits of physical activity on IBD have grown over the last decade, there is still a paucity of data, particularly regarding the type and amount of physical activity from objective measures, to indicate that physical activity is beneficial for improved health outcomes.

Our results are the first to show that the amount of time spent sitting was not different across the 3 groups. Although not significant, IBD-flare participants spent an additional 50 min·d$^{-1}$ sitting compared to healthy controls. These findings suggest that despite the debilitating symptoms associated with IBD, it may not impact the amount of time spent sitting. However, these findings should be interpreted with caution because of the possible under-reporting of time spent sitting. The questionnaire also focused on a typical weekday, which may limit participants to report on their workday in which they may sit for long periods of time (i.e., sedentary office work). To our knowledge there is currently no research in the area of sedentary behavior and IBD. Previous research reports that sedentary behaviors, such as sitting, are related to decreased levels of HRQOL in the general population (65,66) and colorectal cancer survivors (59,67). Future research investigating the relationship between objectively measured sedentary behaviors and HRQOL in people with IBD would be beneficial for understanding the impact of sitting and other sedentary behaviors on health outcomes in this chronic disease.

Our results demonstrated that there were a number of differences between the 2 groups of IBD participants and healthy controls. IBD-remission participants reported a longer disease history than the IBD-flare participants at the time of the study. This suggests that increased time since diagnosis may allow for the discovery of an appropriate treatment approach to control the disease and improve coping strategies. Previous research reports almost 60% of people with IBD undergo surgical treatment (63), which may contribute to improved disease management. The current study was limited by its lack of control for surgical treatment or medical interventions, such as medications. Further, our data indicated that smoking or a history of smoking was more prevalent in people with IBD than healthy controls. Previous research reported that smoking has a protective effect on disease progression in people with ulcerative colitis but is associated with more severe disease outcomes in people with Crohn’s disease (68). Our research supports previous findings that suggests people with IBD are more likely to smoke than healthy controls (69).

A unique finding from the current study was that resilience levels were significantly lower in IBD participants compared to healthy controls. Furthermore, there were no differences in resilience levels between the 2 groups of IBD participants. Our findings suggest that people with IBD report a lower ability to bounce back from adversity than people with no chronic disease, although this difference was an average of only 2.8 points, indicating that despite the debilitating disease this cohort of people with IBD still report relatively high resilience levels. Resilience scores from IBD participants in the current study are similar to previous research with other chronic diseases such as multiple sclerosis (70). However, this cohort of IBD participants reported slightly higher levels of resilience compared to people with fibromyalgia (71). Interestingly, our healthy controls reported lower resilience scores than other adult populations (72), which might explain the small but significant difference between people with IBD and healthy controls in the current study.

Despite the novel and important findings in the present research, there are limitations that should be recognized when interpreting the results. Our findings are limited by a convenience sample and self-reported levels of HRQOL, physical activity, sitting, and resilience. All participants were volunteers who were not randomly selected, limiting the generalizability of the current findings. Furthermore, it is known that there may be bias with self-reported variables, particularly with the overestimation of physical activity and underestimation of time spent sitting (73). However, it is possible both groups over- and under-estimated to a similar extent. Time spent sitting was used as a measure of...
sedentary behavior but there are additional sedentary behaviors such as reclining, which may have been applicable to this population but were not captured from the survey. Future research should be conducted to examine a variety of sedentary behaviors in people with IBD ideally using objective measures of behavior. An additional limitation in the current study is the omission of medical treatment, dietary modifications, and surgical intervention information from the IBD participants to understand how management of their disease may impact physical activity and HRQOL.

To our knowledge, this is one of the first research studies comparing physical activity, sitting, HRQOL, and resilience levels in people with IBD, both in remission and disease flare, with healthy controls. Our findings have important implications for future research in this area. This study confirms previous findings regarding differences in physical and mental HRQOL between people with IBD and healthy controls, and as well provides new evidence for the prevalence of physical activity and sitting, and for determining resilience levels in a relatively large sample of people with IBD. Future research should examine the possible interrelationships among physical activity, sitting, resilience, and HRQOL. Intervention studies comparing different doses and modes of physical activity for people with IBD would be beneficial to understand appropriate exercise prescriptions that do not exacerbate symptoms associated with this chronic disease. Future research would be important to understand whether physical activity interventions or mental skills training, such as cognitive behavioral therapy and/or mindfulness, can benefit HRQOL in people with IBD.

REFERENCES


