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PREVENTION AND REHABILITATION: PILOT STUDY

The effect of aerobic exercises among women with mild and moderate irritable bowel syndrome: A pilot study

Mozhgan Fani [a], Javid Mostamand [a, *], Maedeh Fani [b], Navid Chitsaz [c], Awat Feizi [d]

[a] Musculoskeletal Research Center, Isfahan University of Medical Sciences, Isfahan, Iran
[b] Musculoskeletal Rehabilitation Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[c] Faculty of Medicine, Isfahan University of Medical Science, Isfahan, Iran
[d] Department of Biostatistics and Epidemiology, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran

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ABSTRACT

Background: Irritable Bowel Syndrome (IBS) is a functional bowel disorder characterized by abdominal pain or discomfort. Although patients with IBS are commonly recommended to increase their physical activity, after reviewing the literature, it was found that no study has assessed the effect of aerobic exercises on the severity of symptoms and quality of life in patients with IBS. Therefore the aim of the present study was to evaluate the effect of aerobic exercises with treadmill on the severity of symptoms and quality of life among women with mild and moderate IBS.

Methods: Twenty women with mild and moderate IBS were randomly assigned into two groups of treadmill exercise (10 participants) and control (10 participants). The treadmill group had six weeks (30 min, three sessions per week) of aerobic exercises on treadmill. The control group continued their usual daily activities.

Results: After six weeks of aerobic exercises on a treadmill a significant improvement was observed in the severity of IBS symptoms ($p \leq 0.001$) and IBS quality of life ($p = 0.001$) in the treadmill group compared to the control group. Also in the treadmill group, the severity of symptoms and quality of life demonstrated a significant improvement after the intervention compared to before the intervention ($p \leq 0.001$). No significant difference was observed in the severity of symptoms and quality of life in the control group before and after the study ($p > 0.05$).

1. Introduction

Irritable Bowel Syndrome (IBS) is a functional bowel disorder characterized by abdominal pain or discomfort. IBS is associated with alteration in bowel habits like diarrhea or constipation which have no structural, biochemical or metabolic sources (Keshteli et al., 2015a,b). The symptoms of IBS could be caused by increased visceral sensitivity, bowel movement disorder, and genetic, environmental and psychological factors (Brandt et al., 2009). The prevalence of IBS in Iran is 24% among women and 18.3% among men (Keshteli et al., 2015a,b). There is no relation between the prevalence of IBS and age and educational level. Women suffer from IBS 1.5 times more than men and it is more common among people with lower social and economic condition (Brandt et al., 2009). IBS is one of the most common cause of referring to gastroenterologists (Nellesen et al., 2013). High prevalence of IBS has a significant impact on healthcare costs (Leong et al., 2003). IBS may significantly decrease the quality of life in patients but does not automatically lead to any serious conditions or death (El-Salhy and Gundersen, 2015).

The most significant symptoms of IBS are chronic or recurrent abdominal pain or discomfort associated with diarrhea, constipation or bloating (El-Serag, 2002). The symptoms of IBS vary in intensity over time (Mearin et al., 2004). Patients with IBS have a higher prevalence of migraine, fibromyalgia and depression. (Cole et al., 2006). In Iran about half of the patients with IBS also experience anxiety or depression that is more common in patients in whom IBS constipation is dominant (Farzaneh et al., 2013). It is believed that psychological stress may lead to dysfunction of the autonomic nervous system and gastrointestinal disturbances involving gut-hormone (gastrin, glucagon and motilin) so affecting bowel movements (Fukudo and Suzuki, 1987).

* Corresponding author.
E-mail address: Mostamand@rehab.mui.ac.ir (J. Mostamand).

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Nowadays ROME III criteria are used for the diagnosis of IBS. IBS is diagnosed after eliminating the possibility of other organic diseases. If accurate medical history and full examination is provided (Locke et al., 2002; Longstreth et al., 2006; Spiller et al., 2007) and the patient exhibits no symptoms of rectal bleeding, anemia, fever, history of colon cancer in the family, weight loss, being over 50 years old and extreme changes in the symptoms (Longstreth et al., 2006), IBS may be diagnosed with no further tests. According to ROME III criteria (Uran et al., 2014), IBS is a disorder which its symptoms have started three months prior to the diagnosis. These symptoms are characterized as recurrent abdominal pain or discomfort which has lasted for at least three days per month during the past three months and is associated with two or more of the following items:

Pain decreases or disappears completely after defecation, onset of pain is associated with changes in the frequency of stool and onset of the pain is associated with changes in the appearance of the stool (Uran et al., 2014).

Based on ROME III classification, IBS patients are categorized into four groups: patients with constipation-predominant IBS, patients with diarrhea-predominant IBS, patients with a combination of constipation and diarrhea and finally, patients who could be categorized in any of these groups (Longstreth et al., 2006). The clinical severity of IBS symptoms are categorized into mild (40%), moderate (35%) and severe (25%) groups (Drossman et al., 2011). Mild, moderate and severe cases of IBS are respectively presented by a score of 75–175, 175 to 300 and more than 300 from the IBS severity scoring system (IBS-SSS) questionnaire (Masaeli et al., 2013).

Appropriate suggested treatments for IBS include laxatives for constipation, antimotility drugs for diarrhea, dietary changes, drinking fluids, psychological management and antidepressants for mood changes (Leong et al., 2003).

A number of studies have proven the role of increased physical activity on the symptoms of IBS patients. They have shown that increased physical activity improves quality of life and decreases severity of the symptoms, fatigue, anxiety, depression, abdominal pain and the number of visits to the physician and dieticians (Bengtsson et al., 2006; Johannesson et al., 2010; Jafari and Rahmanian, 2013; Johannesson et al., 2015; Nunan et al., 2015). Johanneson et al in 2010 classified IBS patients to a physical activity group and a control group. The physical activity group was instructed by a physiotherapist to increase their physical activity according to individual factors such as time and costs. The control group was instructed to maintain their lifestyle. Johanneson et al. showed that increased physical activity improves gastrointestinal symptoms and quality of life in IBS patients (Johannesson et al., 2010). The 5 years follow up study showed that increased physical activity had positive long term effects on gastrointestinal symptoms, quality of life, fatigue, depression and anxiety (Johannesson et al., 2015). In another study Jafari and Rahmanian in 2010 evaluated the effects of aerobic exercises on reducing dysphoric mood in patients with IBS. IBS patients did aerobic exercises 3 sessions per week for 9 weeks. At the end of 9 weeks anxiety and depression of IBS patients significantly decreased (Jafari and Rahmanian, 2013). Bengtsson, Ulander et al in 2006 evaluated the effects of a course of instruction on IBS. IBS patient were participated in a programme of instruction on medical care, physical activity, diet, stress management and health insurance. 12 months after the course, there were improvement in abdominal pain, vitality and reduction in the number of visits to physicians and dieticians (Bengtsson et al., 2006).

Literature review revealed that no study has assessed the effect of aerobic exercises with a specific therapeutic protocol on the IBS quality of life and severity of IBS symptoms. Considering the high prevalence of IBS in Iran (Keshteli et al., 2015a,b), and also noting that physical activity has been suggested as the primary modality treatment for IBS (Johannesson et al., 2010), the aim of the present study was to evaluate the effect of aerobic exercises with treadmill on the severity of the symptoms and quality of life among women with mild and moderate IBS.

2. Methods

The present study was a controlled clinical trial which evaluated the effect of aerobic exercises with treadmill on the severity of symptoms and quality of life among women with mild and moderate IBS; results were compared with the results of other women with mild and moderate IBS who only performed their usual daily activities during the same period of the time. The study was performed at the musculoskeletal disorders research center of the rehabilitation faculty of Isfahan University of Medical Sciences. Before data gathering, the study was approved by the ethics committee of the Isfahan University of Medical Sciences. The studied participants were informed about the research nature of the treatment. Then patients who were willing to participate in the study were asked to sign a written informed consent form. All of the personal characteristics of the patients were confidentially recorded for data analysis. Since no similar studies were found, a pilot study with 10 participants in each group was conducted. Considering the higher prevalence of IBS among women than men (Keshteli et al., 2015a,b), and to eliminate the effect of gender, 20 female IBS patients based on the ROME III criteria were enrolled in the study.

Patients were referred to the center by gastroenterologists from across the city. Patients completed IBS-SSS questionnaire for assessing their eligibility for the study. IBS-SSS questionnaire contains five questions which would measure pain severity, pain frequency, abdominal bloating, bowel habit dissatisfaction, and life interference using Visual Analogue Scale (VAS). The mean score of each item ranges from 0 to 100 and the total mean score of the questionnaire ranges from 0 to 500; higher scores indicates more severe symptoms (Bijkerk et al., 2003). The goal and the method of the study were explained for the participants. All of the participants were selected according to the mentioned criteria in Table 1. Place Table 1 here.

Participants were selected through non-randomized simple sampling and were randomly (shaking a dice) assigned into two groups of intervention and control. Patients with odd numbers were allocated to one group and those with even numbers were allocated into the other group. The severity of symptoms and quality of life in both groups were evaluated before the study by IBS-SSS and IBS quality of life (IBS-QOL) questionnaires. Persian version of IBS-SSS and IBS-QOL questionnaires are valid and reliable (Gholamrezaei et al., 2009; Gholamrezaei et al., 2011). Both groups were asked to continue their usual daily activities just like before the study. None of the IBS patients in the treadmill and control groups regularly exercised before the start of study. To perform aerobic exercises, a Turbo 100 treadmill device made in Taiwan was used. The intervention group performed the treadmill exercises three times a week for six weeks (McArdle et al., 2010) based on the following protocol:

First, the target and maximum heart rate were calculated with the formula (target heart rate = 70% maximum heart rate, maximum heart rate = 220−age). The treadmill used was able to record heart rate. The patient's heart rate was recorded by placing her hands on treadmill handles. Then the participants walked on the treadmill with a slow speed for 5 min to warm-up. After that, they increased their speed until they reached the target heart rate and maintained it for 20 min finally, they walked on the treadmill

Table 1
The inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Females with mild and moderate IBS (Drossman et al., 2011). Being able to increase the level of physical activity (Johannesson et al., 2010). Being aged from 18 to 65 years old (Johannesson et al., 2010). Having baseline stable blood pressure (Salacinski et al., 2012).	Doing aerobic exercises (Johannesson et al., 2010). Having a history of rheumatic diseases in lower limb (Thorp et al., 2006; Chang et al., 2007; Debi et al., 2009; Bechard et al., 2012). Having a history of metabolic diseases, neurologic disorders, cardiovascular problems, and respiratory, renal and lung problems which would prevent them from participating in aerobic exercises (Kovar et al., 1992; Ettinger et al., 1997; Mangione et al., 1999; Jafari and Rahmanian, 2013). Having a history of knee injury or knee surgery during the past year (Debi et al., 2009). Having a history of joint replacement in any of the joints of the lower limb (Thorp et al., 2006; Chang et al., 2007; Zeni and Higginson, 2009). Having a history of fracture in the lower limb during the past six months (Thorp et al., 2006). Having clinical symptoms of osteoarthritis in the joints of hip, knee, ankle and foot (Thorp et al., 2006). Major vision disorders (McGibbon et al., 2003; Kim et al., 2011). Hereditary or acquired musculoskeletal disorders in lower limb (Hunt et al., 2010). Organic gastrointestinal disorders (Johannesson et al., 2010). Using drugs that would affect metabolism or balance (Sweetman Sean, 2009). Using assistive devices for walking (Ettinger et al., 1997). Pregnancy (Johannesson et al., 2010).

for 5 min with a slow speed to cool-down (Kisner and Colby, 2012). Treadmill exercise was done with supervision of physiotherapist in all sessions.

In case of patient's desire to stop the exercise, lightheadedness, confusion, cyanosis, pallor and nausea, the exercise program was stopped (Kisner and Colby, 2012). None of the IBS patients in the treadmill and control groups desired to stop exercise. At the end of the final session, the severity of symptoms and quality of life in both groups were measured again using the IBS-SSS and IBS-QOL questionnaires.

3. Results

Demographic characteristics of the participants of the control and treadmill groups are presented in Table 2. All of the data were analyzed using SPSS20 with a significant level of 0.05. Based on the results of Shapirowilk test, variables' distribution was normal. Therefore, to evaluate the severity of symptoms and quality of life, independent *t*-test and paired *t*-test were used.

Studied groups had no significant difference regarding their demographic characteristics including age, educational level, marital status and severity of symptoms ($p > 0.05$). Studied groups had no significant difference in quality of life and severity of symptoms before the study. Place Table 2 here.

Results of independent *t*-test and paired *t*-test for the control and treadmill groups are shown in Table 3. Intra group comparison showed a significant difference between the scores of severity of symptoms and quality of life before and after the intervention in the treadmill group ($p \leq 0.001$) (increasing in quality of life and decreasing in severity of the symptoms). No significant difference was observed between the scores of severity of symptoms and quality of life in the control group before and after the study (intra-group comparison) ($p > 0.05$). Comparing both groups showed that, after completing the therapeutic program, the severity of symptoms had a significant difference between the treadmill and the control group ($p \leq 0.001$) (decreasing in the severity of symptoms). Also the quality of life in the treadmill group had a significant difference with the control group after the intervention ($p = 0.001$) (increasing in the quality of life). Place Table 3 here.

4. Discussion

Based on the conducted literature review, it seems this is the first study evaluated the effect of aerobic exercises with treadmill on the severity of symptoms and quality of life in women with mild and moderate IBS, and compared these results with a control group who only has performed their usual daily activities.

Johannesson et al in 2010 evaluated the effect of physical activity on the severity of symptoms and quality of life among women with IBS. In this study, participants of the control group were asked to continue their usual daily activities for 12 weeks while participants of the intervention group were recommended to increase the level of their physical activity. The researchers showed that increased the level of physical activity may improve the severity of symptoms and quality of life in IBS patients and the severity of symptoms may increase in patients who are physically inactive. Johannesson et al. presented physical activity as the primary treatment modality for IBS patients (Johannesson et al., 2010). In the mentioned study, a specific controlled protocol with determined intensity and frequency did not exist. Results of the present study showed that six weeks of aerobic exercising with treadmill may increase the quality of life and decrease the severity of symptoms in women with mild and moderate IBS, compared to before the intervention. While no significant difference was

Table 2
Demographic characteristics of the treadmill and the control groups.

Variables		Control group	Treadmill group	P value
Age		32.70 ± 10.27 (mean ± SD)	29/10 ± 6.80 (mean ± SD)	0.0386
Educational level	Diploma	4 (40%)	2 (20%)	0.515
	Associate's degree	2 (20%)	1 (10%)	
	Bachelor's degree	2 (20%)	5 (50%)	
	Master's degree	2 (20%)	2 (20%)	
Marital status	Single	4 (40%)	5 (50%)	0.653
	Married	6 (60%)	5 (50%)	
Severity of symptoms	Mild	4 (40%)	4 (40%)	>0.99
	Moderate	6 (60%)	6 (60%)	

Table 3
Comparing the quality of life and the severity of symptoms before and after the intervention between the control and the treadmill groups.

Groups		Quality of life (mean ± SD)	Severity of symptoms (mean ± SD)
Treadmill	Before the intervention	64.03 ± 21.59	203.96 ± 65.69
	After the intervention	89.99 ± 8.53	69.60 ± 51.04
	Paired differences	25.96 ± 14.23	−134.35 ± 45.89
	P value[a]	≤0.001	≤0.001
Control	Before the intervention	70.93 ± 19.72	182.19 ± 78.20
	After the intervention	57.85 ± 16.06	212.82 ± 79.81
	Paired differences	- 13.08 ± 26.14	30.63 ± 55.81
	P value[a]	0.148	0.117
	P value[b] (before the study)	0.465	0.509
	P value[b] (after the study)	0.001	≤0.001

[a] Resulted from paired *t*-test.
[b] Resulted from independent *t*-test based on the mean of differences.

observed between the scores of quality of life and the severity of symptoms of the control group before and after the study. The decrease in the severity of symptoms and the increase in the quality of life in the group who exercised with treadmill and also lack of improvement in the severity of symptoms and quality of life in the group who continued their usual daily activities may indicate that the prescribed program had a desirable effect on the severity of symptoms and quality of life in IBS patients. Therefore, results of the present study were consistent with the results of Johannesson et al. (Johannesson et al., 2010).

In another study, Levy et al in 2005 evaluated the gastrointestinal symptoms of obese patients in a weight loss program and presented the relation of gastrointestinal symptoms with obesity, diet (consumption of fat, fruit and fiber) and physical activity. The participants completed questionnaires about their physical activity, diet and gastrointestinal symptoms at the beginning of and 24 months after the intervention. In this study Levy et al. showed that obesity had a direct relation with abdominal pain and diarrhea. While healthier diet (consuming less fat and more fruit and fiber) and more physical activity may decrease gastrointestinal symptoms (Levy et al., 2005). Decrease in the severity of symptoms in the treadmill group of the present study would support the results of Levy et al.

The participants of both groups in the present study had no significant difference in their demographic characteristics including age, educational level, marital status and the severity of symptoms before the study. Therefore, it could be concluded that all of the occurred differences between the two groups were due to the effects of the applied protocol.

Several mechanisms may contribute to improve the severity of symptoms and quality of life of the treadmill group in the present study. Probably physical and psychological factors are effective. The role of the physical factors may be that due to the increased level of physical activity, gas transit and bowel movements would increase which could be related to the improvement in severity of IBS symptoms (Johannesson et al., 2015). Dainese et al in 2004 showed that moderate physical activity decreases gas transit time and reduces abdominal distension in healthy subjects (Dainese et al., 2004). Also the brain-gut interaction, as the psychological factor, may be effective in the results of the present study; meaning that, stress induces exaggeration of the neuroendocrine response and visceral perceptual, (Posserud et al., 2004), while physical activity counteracts the effects of stress (Dishman et al., 2006). Physical activity, by facilitating the processes of neurogeneratives, neuroadaptives and neuroprotectives of the central nerve system, may have a positive effect on brain-gut axis, which is involved in IBS (Dishman et al., 2006). On the other hand, increased cardiorespiratory fitness and physical activity is associated with less depressive symptoms and greater emotional well-being (Galper et al., 2006). It is speculated that physical activity decreases visceral blood flow, increases gastrointestinal motility, enhances immune function and compression of the gut (Peters et al., 2001). Also, some studies have shown that physical activity decreases colonic transit time and incomplete defecations in patients suffering from chronic constipation (De Schryver et al. 2005), which is a common symptom of IBS (Nunan et al., 2015). Therefore, the results of the present study which showed an improvement in the quality of life and the severity of symptoms in IBS patients after aerobic exercises seem rational.

4.1. Limitations

The potential limitation of the present study was the small sample size and lack of follow-up period to evaluate the effects of aerobic exercises in IBS patients. Another limitation was that only women were included in this study.

4.2. Suggestions

In the future it is recommended to perform further studies with larger sample sizes and follow-up period to evaluate the effects of aerobic exercises in IBS patients.

5. Conclusions

According to the results of the present study, it could be concluded that six weeks of walking on treadmill may significantly decrease the severity of symptoms and improve the quality of life among women with mild and moderate IBS; however, how long term the effects would be, if exercise were to be discontinued, remains unclear.

Conflicts of interest

The authors have no conflict of interests regarding this paper.

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