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Effect of Moderate Aerobic Exercises on Functional Constipation in Premenopausal Women

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ABSTRACT

Background: Hormonal changes in premenopausal women weaken pelvic muscles, causing pelvic dysfunction and functional constipation, impacting health and well-being.

Objectives: To investigate the effect of moderate aerobic exercises on functional constipation in premenopausal women.

Subjects and Methods: Sixty premenopausal women clinically diagnosed with functional constipation, age 40-50 years and BMI was less than 30 kg/m^2, were selected from outpatient clinic of El-Mahalla El Kubra General Hospital, Gharbia, Egypt. There were two equal groups recruited by random assignment; the study group A, consisted of 30 participants who walked on an electronic treadmill for 30 minutes three times a week as part of a moderate aerobic exercises program. For 12 weeks, this group also received general bowel care advice, and the control group B, consisted of 30 participants who similarly received bowel care advice. Before and after the study, all participants in both groups were evaluated by the PAC-SYM questionnaire to assess the severity of constipation symptoms, and by the PAC-QOL questionnaire to measure their quality of life.

Results: There was a significant reduction in the mean values of the PAC-SYM and the PAC-QoL in both groups post treatment, favoring group (A) (P = 0.001).

Conclusions: Premenopausal women experiencing functional constipation can benefit from an intervention program that incorporates moderate aerobic activity, since it significantly alleviates symptoms and improves QOL.

Keywords: Aerobic Exercises, Functional Constipation, Premenopausal Period, Quality of Life.

INTRODUCTION

Constipation is one of the most common medical problems that influence individuals worldwide. Constipation is defined as an inability to pass feces or prolapsed colon. This condition's symptoms can vary greatly and may include things like straining, anorectal blockage, incomplete evacuation, stomach discomfort, bloating, pain in the lower abdomen, and firm stools [(1)]. The emotional and physical problems related to constipation can have a significant impact on quality of life (QOL). A sedentary lifestyle, lack of physical activity, aging, and poor dietary habits (such as a low fiber intake) are some of the many variables that can lead to constipation [(2)].

The classification of Functional Intestinal Constipation (FIC) as a functional gastrointestinal ailment is relied on the criteria established by the Consensus of Rome IV. FIC is characterized by intestinal constipation that does not have an organic cause [(3)]. There are three main types of FIC. The most common is normal transit constipation, which happens when the muscles involved in bowel movements do not work properly. Slow transit constipation prevents waste from being expelled efficiently because the colonic transit time is delayed. Defecation disorders involve dysfunction in the specific muscles of the colon that are responsible for evacuation [(4)].

The last years of a woman's reproductive life are surrounded by a transitional phase known as the perimenopausal period. It is marked by the first monthly irregularity and continues for a year following amenorrhea. Hormonal and reproductive changes that accompany it can affect a woman's digestive system and general health in major ways [(5)]. Alterations to the levels of the hormones estrogen and progesterone impact gastrointestinal motility in women at this time [(6)].

As ovarian function decreases throughout the perimenopausal or menopausal transition, the endocrine system shifts from transferring the normal estrogen cycle of the reproductive years to the estrogen dip of menopause. During this time, the levels of follicle-stimulating hormone and luteinizing hormone are very high, but the levels of estrogens, such as estriol, estradiol, and estrone, are very low [(7)]. In the presence of estrogen, the pelvic organs and the supporting muscles and connective tissues function properly. Perimenopausal hormonal changes might induce pelvic floor dysfunction by weakening the pelvic floor muscles [(8)].

Medications and non-medication approaches are usually used in the management of constipation. One of the most common pharmacological approaches to treating constipation is the use of laxatives. While effective in providing short-term relief, the prolonged use of laxatives has been associated with several clinical issues, including dependency and potential disruption of the natural bowel function [(9)]. As a result, non-pharmacological interventions, including dietary changes, are commonly recommended to help alleviate symptoms and prevent recurrence of constipation [(10)].

The biomechanical stimulation of the gastrointestinal tract during high-impact activities like running and better colonic motility are some of the various health benefits of regular physical activity [(11)]. Regular exercise is associated with an improvement in defecation patterns and colonic transit time in middle-

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aged, sedentary individuals who suffer from chronic constipation [12, 13].

Given that constipation is a prevalent issue for many women during the perimenopausal and menopausal transitions, moderate aerobic exercises are effective management technique for promoting gastrointestinal health and treating constipation in this population. The study's aim was to investigate the effect of moderate aerobic exercises on functional constipation in premenopausal women, which provide light on their potential benefits and emphasize the significance of lifestyle changes in boosting overall well-being and may provide a more accessible and comprehensive strategy to managing constipation in premenopausal women.

SUBJECTS AND METHODS

Study design:

This study was designed as randomized controlled trial. It was conducted from April 2023 to January 2024.

Eligibility criteria:

This study involved sixty premenopausal women clinically diagnosed with functional constipation; they were selected from outpatient clinic of El-Mahalla El Kubra General Hospital, Gharbia, Egypt.

They ranged in age from 40 to 50 and had a BMI of 30 or lower. They had relatively identical lifestyles. They met at least two of the Rome III diagnostic criteria for constipation as listed below:

- Fewer than three spontaneous bowel movements per week.
- Straining during at least 25% of defecation attempts.
- Lumpy or hard stools for at least 25% of defecation attempts.
- Sensation of anorectal obstruction or blockage for at least 25% of defecation attempts.
- Sensation of incomplete defecation for at least 25% of defecation attempts.
- At least 25% of defecation efforts necessitate manual maneuvers, such as digital evacuation or pelvic floor support.
- It is rarely to have loose stools without the usage of laxatives.

Participants with a history of inflammatory bowel illness, anal fissure, bowel surgery, irritable bowel syndrome, metabolic or endocrine diseases, musculoskeletal or neurologic disorders, were not allowed to participate in the study [14].

Randomization:

Before data were collected, a computer-generated random table was produced using SPSS (version 26 for Windows software) to ensure randomization. A unique identifying number was assigned to each participant. These numbers were randomized into two groups with numbers (n=30). The index cards were put into opaque envelopes, and numbering each one. Each participant received a randomly selected envelope from a blinded and impartial research assistant. After the envelopes were opened, the individuals were assigned to their respective groups.

Group (A) (study group); completed a 12-week program of moderate aerobic exercises consisting of 30-minute sessions, three times weekly, along with general instructions on bowel care and **Group (B) (control group);** received bowel care advice only as in group (A) for 12 weeks.

METHODS

A. Evaluative instrumentations:

1. **Recording data sheet:** Served to document the individual's medical, personal, and menstrual history for both groups.
2. **Prior to the start of the trial,** all participants in both groups (A and B) had their weight and height measured using a standard scale in order to determine their BMI.
3. **Patient assessment of constipation symptoms (PAC-SYM):** The frequency and severity of constipation symptoms as perceived by the patient can be accurately measured using this valid and reliable instrument. A total of twelve items make up the questionnaire, with four items devoted to abdominal symptoms, three to rectal symptoms, and five to stool symptoms. Each item is given a score out of five. Symptom severity is rated from 0 (no symptoms at all) to 4 (very severe) on comparable scales. A lower total score suggests a less bothersome group of symptoms; an average total score between 0 and 4 is derived by dividing the total score by the number of items completed [15].
4. **Patient assessment of constipation quality of life (PAC-QOL):** When compared to other questionnaires designed to measure constipation-related QOL, the PAC-QOL offers the best level of validity and specificity. Using daily individual health evaluation and functioning, this concise yet thorough instrument examines constipation. There is a total of 28 separate categories that patients can self-report. These are categorized as follows: 4 physical discomfort, 8 psychological discomfort, 5 treatment satisfaction, and 11 worries and discomfort. The scores for items 25, 26, 27, and 28 should be reversed because these questions are positive. The Likert scale ranges from 0 to 4. Worst impacts on quality of life are associated with higher ratings [16].

B. Treatment instrumentations:

Electronic treadmill: (Motorized Treadmill (DX 12 – DKB), Model X1spro, made in China, Motor Power: AC3 0HP, Rated Volt:220V-240V, and Frequency:50/60HZ) was used to perform aerobic exercise program for all participants in group (A).

Treadmill model (DX 12 – DKB) consisted of large display, which offers easy viewing, simple control and

ultimate deck system for greater performing and durability. The type of display includes a DOT- Matrix LCD with alphanumeric feedback, time, distance, speed, calories, pulse, and a power button. The following specifications were listed for the deck: reversible design with ultimate hard wax; 60 x 25 inches for the running surface; 7.5 inches for the deck step height; an ultimate cushioning system; contact heart rate sensors; and an HR receiver.

Procedures:

1- General bowel care advice:

All participants in both groups were advised to follow general bowel care advice for 12 weeks as follows:

Everyone was advised to make sure they were getting enough fibers (20 to 35 grams daily). Avoid caffeine – containing foods and beverages. Stay hydrated by drinking 1.5 to 2 liters of water daily. The correct way to defecate includes sitting with your knees higher than your hips (or using a foot stool or other flat, stable object if needed), leaning forward with your elbows on your knees, relaxing your abdominal muscles, and straightening your spine [(14)].

2- Aerobic exercises:

Individuals in group (A) were given a 12-week regimen of moderate aerobic exercises that consisted of three 30-minute sessions:

Every participant was given a verbal explanation of the significance of this treatment program before to the first session in order to establish trust and encourage cooperation. Everyone was told to drink a lot of water before and after the exercise so they would not lose too much water in their bodies. Everyone taking part was advised to dress comfortably and wear flat, light shoes to lessen the impact of the platform's friction. The therapist stood close to the participant, inspected for indications that the activity was being stopped, such as dexterity, and kept asking whether she was experiencing pain, lightheadedness, or dyspnea.

Exercise program:

There were three stages to the moderate aerobic exercise program that each participant of group (A) followed for 30 minutes while walking on an electronic treadmill:

Warm up phase: comprised a 5-minute interval of light-intensity treadmill walking at 40% of maximal heart rate (MHR).

Actual phase: included 20 minutes of moderately intense treadmill walking (60–75% of MHR).

Cool down phase: involved a 5-minute treadmill walk at a light intensity (40 % of MHR), MHR was calculated according to the equation MHR = (220-age). The frequency of exercise was 3 times / week for 12 weeks [(17)].

Sample size estimation:

Based on the overall score PAC-SYM questions from the study by **Tantawy *et al.*** [(17)] G*Power 3.1.9.2 (Universität Kiel, Germany) was used to calculate the sample size. The following factors were taken into account: a power of the study at 95%, an effect size of 1.03, a 1:1 group ratio, and a 95% confidence interval. The minimum required sample size was 52 patients (26 per group), and four more were added to each for potential dropouts. So, a total of sixty patients were required, with thirty assigned to each group.

Ethical Consideration:

Research Ethics Committee of Cairo University's Faculty of Physical Therapy in Cairo, Egypt, stamped its permission on this research (No. P.T.REC/012/004490). All participants signed a written informed consent before the study's start. The study adhered to the Helsinki Declaration throughout its execution.

Statistical analysis

The data were expressed using the mean ± standard deviation. In order to compare the two groups' subjects, an unpaired t-test was used. The normality of the data distribution was checked using the Shapiro-Wilk test. Within and between groups, researchers analyzed the effects of the evaluated variables (severity of constipation symptoms and patient quality of life) using mixed MANOVA. The statistical package for the social sciences, version 20, for Windows (SPSS Inc. of Chicago, Illinois, USA), was used for data analysis. When the p-value was 0.05 or lower, it indicated statistically significant results.

RESULTS

Table (1) displays the descriptive statistics for the demographic data of the patients in both groups (A and B). None of the demographic variables (age, weight, height, and BMI) differed significantly across the two groups.

Table (1): Mean values of physical characteristics of both groups (A and B)

	Group A (n=30)	Group B (n=30)	t -value	P
Age (years)	45.4±3.14	45.73±3.08	-0.42	0.680
Weight (kg)	78.96±4.69	80.17±4.7	-0.99	0.322
Height (cm)	170.37±5.79	171.04±4.43	-0.503	0.617
Body mass index (kg/m^2)	27.26±1.89	27.43±1.63	-0.38	0.706

Data are displayed as mean ± SD, t: unpaired t- test.

Within group comparison

The mean severity of constipation symptoms decreased significantly in Group (A) after therapy compared to its comparable value before treatment, with a mean difference of 1.63. In Group (B), the mean severity of constipation symptoms decreased significantly after treatment compared to its pre-treatment value, with a mean difference of 0.96. In group (A), the mean severity of constipation symptoms decreased by 65.5%; in group (B), it decreased by 38.5% (Table 2).

Between groups comparison

Neither group differed significantly from the other before treatment. Despite this, group (A) had a significantly post-treatment lower value compared to group (B), indicating the superiority of group (A) (Table 2).

Table (2): Mean values of severity of constipation symptoms measured pre and post treatment in both groups (A and B)

	Group A (n=30)	Group B (n=30)	Mean difference	P value	η^2
Pre-treatment	2.49±0.72	2.49±0.71	0	0.991	0.001
Post-treatment	0.86±0.54	1.53±0.85	-0.67	0.001*	0.186
Mean difference	1.63	0.96			
% of change	65.5%	38.5%			
P value	0.001*	0.001*			

Data are displayed as mean ±SD, *: significant as P value ≤ 0.05., η^2: partial eta squared.

Within group comparison

In Group A, the average QOL of the patients decreased significantly after treatment compared to its pre-treatment value, with a mean difference of 1.34. According to Group (B), the average QOL of the patients significantly decreased after treatment compared to its pre-treatment value, with a mean difference of 0.45. Patients' QOL decreased by 52% and 18% in groups A and B, respectively (Table 3).

Between groups comparison

The two groups were not significantly different before treatment (P=0.400). Group (A) had a significantly post-treatment lower mean value compared to group (B), indicating the superiority of group (A) (Table 3).

Table (3): Mean values of patient's QOL measured pre and post treatment in both groups (A and B)

	Group A (n=30)	Group B (n=30)	Mean difference	P	η^2
Pre-treatment	2.59±0.48	2.48±0.58	0.11	0.400	0.012
Post-treatment	1.25±0.58	2.03±0.6	-0.78	0.001*	0.306
Mean difference	1.34	0.45			
% of change	52%	18%			
P value	0.001*	0.001*			

Data are presented as mean ±SD.*: significant as P value ≤ 0.05, η^2: partial eta squared.

DISCUSSION

The premenopausal phase is marked by hormonal swings, primarily of estrogen and progesterone, which are known to affect bowel function. While estrogen tends to decrease the time it takes for food to move through the digestive tract, progesterone does the opposite by relaxing smooth muscle tissue throughout the body, including the intestines, which can slow down bowel transit time leading to constipation [18].

The estimated prevalence of constipation globally varies from one percent to eighty percent, making it a widespread ailment requiring health treatment [19]. It manifests itself in irregular bowel motions that occur three or four times a week, along with persistent difficulties in evacuation and a sensation of incomplete evacuation. Research has indicated that these symptoms can hinder the improvement of various aspects of people's health and functioning. This includes their everyday activities, emotional and social well-being, personal health, and overall QOL [20].

Different types of medication can be used to treat constipation, such as those that soften stool, osmotic agents, chloride channel activators, and bulk-forming agents. Constipation, hypomagnesaemia, hyperphosphatemia (a potentially fatal condition), and an increased risk of fecal incontinence are only a few of the serious health issues linked to long-term use of laxatives and soft stool [9].

Aerobic exercise is described as continuous movement that lasts 15 to 60 minutes at a moderate intensity (60 to 90% of MR) over an extended period of time. Consistent aerobic activity promotes regular bowel movements by increasing the motility of the digestive tract. Constipation, gas accumulation, and bloating can all be avoided with regular bowel movements made easier by increasing motility in the digestive tract [21].

A healthy digestive system and the avoidance of constipation depend on regular, proper bowel care. To promote regular bowel movements, eat plenty of fiber-rich fruits, vegetables, and whole grains and drink enough of water throughout the day [22].

Hence, the purpose of this research was to find out whether premenopausal women who engaged in moderate aerobic exercise improved their functional constipation.

The favorable impact of aerobic exercises on treating and avoiding constipation, as demonstrated by the considerable improvement in group (A) results, can be attributed to the following mechanisms: To begin, doing physical activity has an effect on colonic mobility and speeds up gastrointestinal transit [23].

During physical activity, the gut is mechanically stimulated by movements like jumping, keeping an upright posture, and contracting the abdominal muscles. This mechanical stimulation aids in the movement of feces into the rectum. Additionally, the elevated energy expenditure during physical activity influences the amount of food that people eat [24]. Second: Aerobic exercise enhances colonic motility by stimulating the enteric nervous system and increasing parasympathetic activity, which promotes more efficient peristalsis [25]. Optimal nutrition is an essential element in regulating gastrointestinal motility; a high-fiber diet can raise stool weight, which in turn reduces colon transit time [26].

After 6 weeks of treatment, the efficacy of aerobic exercise on the severity of constipation symptoms was evaluated. Aerobic exercise improves QOL and reduces symptom severity in women with chronic constipation [27].The results of the current study agreed with that of **De Schryver *et al.*** [28] who discovered that regular exercise alleviates constipation by enhancing their recto-sigmoid or total colonic transit time and their feces pattern.

Also, the study's results were in line with that of **Barololoum** [29] who found that young, inactive people with persistent constipation progressed better after walking for an hour daily at 60% of their maximal heart rate.

The study's findings were corroborated by **Soheilipour *et al.*** [30] who assessed the effectiveness of a 12-week brisk walking regimen on middle-aged women with functional constipation and reported that the women's constipation symptoms significantly improved.

Additionally, **Gao *et al.*** [2] assessed the benefits of exercise for constipation treatment. Having shown that aerobic exercise considerably alleviated constipation symptoms, they concluded that it might be a viable and effective treatment choice for patients with constipation.

The significant improvement in PAC-QOL may be associated with the alleviation of constipation symptoms. This is in line with the results of **Nour-Eldein *et al.*** [31] who found that patients' constipation symptoms and QOL were significantly improved when they increased their physical activity levels.

Also, the current findings were in line with that of **Gandhi and Gunjal** [21] who studied the end-effects of a 4-week aerobic training and core strengthening program on functional constipation. After therapy, patients' total PAC-SYM and PAC-QOL scores were much lower than their pre-treatment levels.

Also, the study's findings were corroborated with those of **Asgari *et al.*** [32] who found that completed aerobic exercises consisting of walking for 30-45 minutes, three times weekly for four weeks significantly improved QoL for postmenopausal women with functional constipation.

LIMITATIONS

From the author's perspective, this study was limited by personal and individual differences between the participants. Each individual's response to the exercises may vary depending on their current emotional and physical health as well as their surrounding environment. Also, the study was conducted for short term duration with no patients follow up. So, these limitations should be considered in future studies.

CONCLUSION

Moderate exercise significantly improved the QOL and reduced the severity of constipation symptoms. As a

result, they may be incorporated into the intervention program for premenopausal women who suffer from functional constipation.

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