ORIGINAL ARTICLE

Effect of six weeks of whole-body vibration in treatment of postnatal constipation

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Abstract

Objective: To determine the efficacy of whole-body vibration in the treatment of postnatal constipation.

Method: The prospective, randomised, single-blind, pre-post, controlled trial was conducted from December 2020 to May 2021 at the outpatient clinic of the Obstetrics and Gynaecology Department, Kafrelsheikh University Hospital, Egypt, and comprised women with complaint of postnatal constipation. They were randomised into two groups. Group A was subjected to whole-body vibration in addition to diet instructions, pelvic floor exercises and static abdominal exercises for six weeks. Group B was subjected to pelvic floor exercises, static abdominal exercises and diet instructions. Constipation symptom questionnaire and patient assessment of constipation quality of life questionnaire were used at baseline and post-intervention. Data was analysed using SPSS 25.

Results: Of the 40 women, 20(50%) were in each of the 2 groups. Group A mean age was 24.88±2.22 years, while it was 24±2.25 years in Group B. Age, height and body mass index were not significantly different between the groups ($p>0.05$). There was significant improvement in Group A quality of life and constipation severity ($p<0.05$).

Conclusion: Whole-body vibration had positive impact on postpartum women's constipation symptoms and quality of life.

Keywords: Pelvic floor, Vibration, Constipation, Postpartum period, Diet, Postnatal women.

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Introduction

A common disorder affecting postpartum mothers is postpartum constipation. Constipation occurs postpartum in a significant number of women and can also continue up to 12 months after delivery in some individuals.[1]

The postpartum period, or puerperium, begins around one hour after the placenta is delivered, and lasts 6 weeks, while the delayed postpartum period can last for up to 6 months.[2] For a number of reasons, constipation is a common concern during the postpartum period. Bowel tone and gastric motility, which gets decreased by progesterone during pregnancy, remain depressed for several days.[3]

Postpartum constipation is suspected to occur by elevated levels of progesterone hormone during pregnancy, while lack of dietary fibre and water are factors in the aetiology of constipation during and after pregnancy. Also, abdominal wall relaxation increases constipation and gas distention. During labour, restricted fluid and food intake may lead to form hard stools. Perineal trauma, episiotomy and haemorrhoids cause pain and affect the normal bowel emptying. Many women experience pain during defecation and are unable to feel pressure on the perineum.[4]

Since the pelvic floor muscles have an important role in defecation, childbirth may lead to injury to the levator ani muscle, causing constipation in the postpartum period.[5] Chronic straining, advanced age, physical conditioning, and increased intra-abdominal pressure in cases of obesity and pregnancy can all have an impact on this muscle structure and function. Pelvic floor damage during pregnancy and strain during normal labour may be the primary reasons of postpartum defecation difficulties.[6]

The most frequent pharmacological treatment for postpartum constipation is laxatives, although laxatives have considerable adverse effects and hazards associated with both short-term and long-term use.[7]

Whole-body vibration (WBV) has been utilised to induce mechanical oscillation to build strength, and to improve bone mineral density (BMD) and balance at various frequencies, amplitudes and accelerations.[8] WBV is considered to influence the skeletal, muscular, endocrine, neurological and circulatory systems through oscillatory motion. WBV was studied in patients suffering from a variety of diseases, including stroke, Parkinson's disease, and postmenopausal osteoporosis.[9] It is

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also hypothesised that biomechanical oscillations can boost gastrointestinal motility during physical activity to some extent.[10]

WBV is a new intervention to improve muscle power, endurance, coordination, neuromuscular issues, etc. WBV is used to improve muscle strength due to its effects on the neuromuscular system,[11, 12] muscle hypertrophy, proprioceptor enhancement[13], as well as on enlargement and hormonal modifications of slow and fast twitch fibres.[12] WBV also appears to be effective in enhancing weak muscle strength, especially in patients with various chronic diseases who are unable to contract their muscles.[14-16]

Chronic postnatal constipation can lead to anal fissure and painful piles that affect the usual daily routine of the mothers, and can decrease the quality of life (QOL) during the puerperium phase, while the discomfort not only affects the health of the mother, but also impacts the wellbeing of the baby.[1] Colonic harm can be induced by excessive use of laxatives, thus exacerbating the issue of constipation, and repeated use of laxatives causes colonic mobility loss and contributes to intractable constipation.[17] As such, WBV needs to be explored for its effect on treating postnatal constipation as well as postnatal QOL. The current study was planned to determine WBV efficacy in the treatment of postnatal constipation.

Patients and Methods

The prospective, randomised, single-blind, pre-post, controlled trial was conducted from December 2020 to May 2021 at the outpatient clinic of the Obstetrics and Gynaecology Department, Kafrelsheikh University Hospital, Egypt. After approval from the ethics review committee of the faculty of Physical Therapy, Cairo University, Egypt, the study was registered with ClinicalTrials.gov (ID: NCT05286476). The sample was raised using convenience sampling technique. Those included were women aged 22-35 years with body mass index BMIs 30-32kg/m^2 who had given birth vaginally and were complaining of postnatal constipation 2-6 weeks post-delivery. Those excluded were cases suffering from hypertension (HTN), cardiac issues or diabetes mellitus (DM), women who had history of inflammatory bowel disease and abnormalities of the anal region or anal fissure, women who had history of bowel surgery other than appendectomy, patients who had endocrine disease or digestive tract disease and those with neurological or muscular disorders.

After taking informed consent from the subjects, the sample was randomised into two equal groups. For the purpose, a research assistant who was blinded and an independent person were asked to open sealed envelopes containing computer-generated randomisation cards to form intervention Group A and control Group B. Both the groups received diet instructions in addition to pelvic floor exercises and static abdominal exercises for 6 weeks.

With respect to the intervention, Group A received WBV therapy in 15-minute sessions. Vibration was administered for 1 min, with a rest interval of 1 min between each vibration set, repeating 10 vibrations at 30Hz frequency and amplitude 0-2mm at a speed of 50m/s.[18] These sessions were conducted 3 days a week for 6 weeks. WBV was induced using a non-invasive oscillation platform (AV-001; Body Green, Taipei, Taiwan).

To avoid adverse effects, like dizziness from vibrations to the head, the subject was instructed to stand comfortably on the WBV platform with the knees bent at around 20° and with her hand having a firm grasp of the device handles.

During pelvic floor exercises, all the subjects in both the groups were asked to lie in crook lying position and to try to contract as they control the bowel action, and to repeat the hold-then-relax cycles till they could tolerate. For static abdominal exercise in the same position, the subjects were asked to contract their abdominal muscles and repeat the hold-then-release cycles at home. They were advised to eat balanced diet rich in fibres, and to drink sufficient water while avoiding caffeine intake.

Each subject in both the groups was evaluated using the Patient Assessment of Constipation-Symptom (PAC-SYM) questionnaire[19] and the Patient Assessment of Constipation Quality of Life Questionnaire (PAC-QOL)[18] at baseline and after 6 weeks of intervention.

The 12-item PAC-SYM measures the frequency of abdominal, rectal and stools symptoms and severity of constipation. Items are scored on a 4-point scale, with 4 grades where higher scores indicate worse symptom severity.[19] The validated PAC-QOL consists of 28 items grouped into 4 subscales; complaints and concerns, physical pain, psychosocial pain, and satisfaction.[18]

The sample was calculated using G*power 3.0.10 with effect size 0.9 on the basis of a pilot study conducted on 10 subjects at a power level of 80% with alpha 0.05.[20]

Data was analysed using SPSS 25. Variable were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), as appropriate. According to the normality test, intra-group and inter-group PAC-QOL were done using 2x2 mixed design multivariate analysis of variance (MANOVA). Inter-group comparison of PAC-SYM was done using Mann-Whitney U test, while intra-group analysis was done using Wilcoxon signed ranks test. $P<0.05$ was considered statistically significant.

Results

Of the 40 women, 20(50%) were in each of the 2 groups. Group A mean age was 24.88±2.22 years, while it was 24±2.25 years in Group B. Age, height and BMI were not significantly different between the groups (p>0.05) (Table 1).

There was significant improvement with respect to both PAC-SYM (Table 2) and PAC-QOL (Table 3). There was a significant interaction of treatment and time (Wilks' Lambda = 0.05; F = 215.297, p = 0.0001, = 0.95). There was a significant main effect of time (Wilks' Lambda = 0.034; F = 316.991, p = 0.0001, = 0.966). There was no significant main effect of treatment (Wilks' Lambda = 0.067; F = 155.974, p = 0.0001, = 0.933).

Table-1: Participants' characteristics.

	Study group $\bar{x}$±SD	Control group $\bar{x}$±SD	*t- value*	*p- value*
Age (years)	24.88±2.22	24±2.25	1.36	0.18
Height (cm)	161.44±3.01	161.04±4.98	0.337	0.738
BMI (kg/m2)	29.12±2.16	28.55±1.91	0.959	0.343

x: Mean, SD: Standard deviation, BMI: Body mass index.

Table-2: Constipation questionnaire responses for study groups at different training periods.

	Pre-treatment Group (A) Median (IQR)	Group (B) Median (IQR)	Post-treatment Group (A) p- value	Group (B) Median (IQR)	Median (IQR)	*p-value*	Repeated measures (group A) *p-value*	Repeated measures (group B) *p-value*
Abdominal	7 (3)	8 (4)	0.466	1 (1)	2 (4)	0.008*	0.001*	0.001*
Rectal	7 (2)	8 (4)	0.285	1 (1.5)	4 (3.5)	0.001*	0.001*	0.001*
Stool	9 (1)	9 (1)	0.87	1 (2)	5 (1.5)	0.001*	0.001*	0.001*

IQR: Interquartile range. * Significant.

Table-3: Mean quality of life (QOL) scores at baseline and post-intervention.

	Pre-treatment Group A	Group B $\bar{x}$±SD	Post-treatment Group A *p-value*	Group B $\bar{x}$±SD	$\bar{x}$±SD	*p-value*	Within group (A) *p-value*	Within group (B) *p-valuee*
Physical discomfort	5.6±1.35	5.28±1.24	0.388	1.76±0.72	4.36±1.31	0.001*	0.001*	0.001*
Psychological discomfort	26.44±2.59	27.24±2.27	0.253	11.12±2.57	25.72±2.54	0.001*	0.001*	0.019*
Worries and concern	32.72±3	32.76±1.92	0.956	10.72±2.57	31.92±2.13	0.001*	0.001*	0.188
Satisfaction	3.72±1.24	4.12±1.23	0.259	13.32±1.24	5.4±1.55	0.001*	0.001*	0.001*

$\bar{x}$: Mean, SD: Standard deviation. * Significant.

At baseline, there was no significant difference between the groups (p>0.05). Group A post-treatment physical, psychological and anxiety levels significantly decreased compared to Group B (p<0.05). Intra-group comparisons showed a substantial decrease in physical and psychological discomfort (p<0.05) and a significant increase in satisfaction (p<0.05) in both groups. Additionally, concerns and worries in Group A decreased significantly (p<0.05) post-treatment compared to baseline. There was no discernible difference (p>0.05) in Group B.

Discussion

Only a few studies have specifically evaluated the effects of WBV therapy on severe constipation, particularly on the abdomen, which reported that the external oscillatory movement applied to the abdomen dramatically improved motility and reduced constipation in the elderly.[21]

The current study showed a significant improvement in the WBV group, which is in line with Lamas et al.[21]These changes are attributed to the stimulation of abdominal vibration, which has been documented to increase gastrointestinal tract motility and decreases colon transport period time as well as constipation.

It is believed that the mechanism by which abdominal physical stimulation decreases constipation includes stretch receptor activation, which can enhance the gastrocolic reflex, activate the contraction of the intestinal and rectal muscles, and induce somato-autonomic reflexes.[22, 23]

A study[24] explained that the human body is a complex biomechanical and physiological system distinguished by rigid and trembling masses, both of which are influenced by sinusoidal movement. The fast and abrupt changes in the muscle-tendon complex and length of the anti-gravity muscles are dictated by the sinusoidal characteristics of the vibration stimuli.

Additionally, it has also been suggested that vibration may cause excitatory flow in the overall motoneuron inflow through short spindle motoneurons connections. The reflex response to vibration stimulation has primarily been attributed to the stimulation of muscle spindles, leading to an enhanced activity of the muscle spindle's sensory ending. The primary endings are more sensitive to vibrations than secondary endings and Golgi tendon organs. However, it has also been demonstrated that when vibrations are administered to a muscle that is tonically

tensed, Golgi tendon organs are incredibly sensitive.[24]

WBV is a somatosensory proprioception stimulus with a long-lasting postural influence, IA and II afferent pelvic floor muscle spindle fibres are susceptible to small vibration-stimulated muscle length alteration, and proprioceptive receptor stimulation might initiate stretch and cutaneous reflexes.[25]

The current results also match those of Choong-Kyun et al.,[26] who claimed that parasympathetic stimulation enhances gastric motility, enhances secretion, and relaxes the sphincters. A parasympathetic division of the gastrointestinal tract that promotes motility is produced by physical stimulation of the abdomen. Thus, WBV stimulates abdominal vibration to induce peristalsis, improve colonic transit time, increase bowel movement regularity and reduce discomfort in constipated patients which lead to QOL improvement.

The current study has limitations in the shape of the lack of prolonged follow-up of WBV effect post-rehabilitation. Besides, the participating women had different educational levels which might have affected their understanding level and execution of routine exercises at home. Further studies are needed with larger sample sizes, longer study duration and covering different WBV parameters.

Conclusion

WBV had positive impact on postpartum women's constipation symptoms and QOL. WBV represents a novel intervention for the treatment of constipation in postnatal women without side effects on mothers and their babies.

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Conflict of Interest: None.

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