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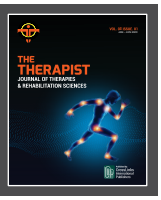

Systematic Review

Effect of Whole-Body Vibration During Chemotherapy in Improving Functional Outcomes of Patients with Malignancies

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ABSTRACT

The use of functional outcome scales to see the effect of whole-body vibration on the patients having malignancies and going through chemotherapy. **Objective:** To perform a systematic review to see the effects of whole-body vibration on patients having chemotherapy. **Methods:** Using the specified keywords, a search was conducted in the TRIP, PEDro and PubMed databases. The studies were picked based on their eligibility for evaluation. The articles having full length were included which specified the effect of whole-body vibration technique in the patients having malignancies and going through chemotherapy. **Results:** According to the exclusion criteria, three publications were included, all related to patients having chemotherapy. Reported were the effects of WBV both in sensory and motor symptoms. **Conclusions:** It was concluded that by using the whole-body vibrator the debilitating effects of the chemotherapy can be controlled or minimized such as fatigue, weakness and bone loss. It is comparative to high intensity exercises which account behavioral barriers and certain risks.

INTRODUCTION

Cancer is a group of disease characterized by unchecked and abnormal growth of cells having two types; Benign in which the disease or tumor remain localized neither invading surrounding cells nor spreading throughout the body. The other type is Malignant in which it spread in the surrounding tissues and in some cases throughout the body. In Pakistan, according to a survey, 148000 people are diagnosed with tumor every year with leukemia and non-Hodgkin lymphoma being most common [1]. The rate of incidence of lymphoma is 5.3/100,000 and 4.1/100,000 in males and females respectively with five-year survival rate of 87% [2, 3]. It is most common in early adulthood, particularly people in their 20s and the older above 60 years of age [4]. The incidence of leukemia is 4.1/100,000 in males and 2.1/100,000 in females [5]. with five-year survival rate of 61.4% [6]. It is most common in early ages of teens and the older age of 55 years and above [7]. In malignancies several treatments are used like surgeries, radiation

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therapy, immunotherapy, hormone therapy, bone marrow transplant, cyber knife and one being chemotherapy. In chemotherapy the powerful drugs are used to kill the fast-growing cells, where it has the beneficence of killing abnormally growing cells it also has an adverse effect like decreasing the immune system of body leading to fatigue, weight loss, hair loss, osteoporosis, general feeling of sickness, anxiety, depression and other debilitating effects on body. To deal with the adverse effects of chemotherapy certain physical exercises and rehabilitation programs are used. Evidence has shown the effects of whole-body vibration in this phase as it stimulates the neuromuscular system without having adverse effects on blood pressure [8]. Studies have also demonstrated the value of whole-body vibration workouts in the rehabilitation of individuals with chronic illnesses. A growing number of studies are looking into how whole-body vibration affects cancer survivors' functional exercise ability, weariness, weakness, incontinence, bone loss, and peripheral neuropathy [9]. WBV is likewise proposed as a possibly protected, low power option in contrast to current modalities in work out prejudiced, practice aversive or portability restricted people, without the expected gamble or social obstructions related with extreme focus work out [10]. Constructive outcomes following a month and a half of moderate WBV preparing with a transcendently vertical vibrating gadget has been accounted for in old standardized subjects in contrast with different mediations [11]. It is considered to be gentle on joints and has least effects on the blood pressure, heart rate decreasing the complications [12]. Ongoing examinations demonstrate that very low-level mechanical signs conveyed deep down in adequate recurrence reach can be anabolic. In the event that these mechanical signs can be successful and painlessly sent into the standing human to arrive at those destinations of skeleton at the most serious gamble of osteoporosis, for example, the hip and lumbar spine, then, at that point, vibration could be utilized as extraordinary, non-pharmacological mediation to forestall or switch bone misfortune [13]. Entire body vibration is another sort of activity that has been progressively tried for the capacity to forestall strong decay, bone breaks and osteoporosis. Contrasted with conventional preparation systems entire body vibration needs essentially less time and thusly could be anticipated to arrive at a higher consistence in already idle patients [14-16].

METHODS

PubMed, PEDro and TRIP databases were searched by using medical subject heading (MeSH terms). These databases were selected due to their large and open access to medical and rehabilitation material. A PICO (population, intervention, comparator, outcome) question were used to define the keywords. The PICO question was 1) population= diseased population, patients having malignancy and going through chemotherapy 2) intervention= whole body vibration 3) placebo or any other treatment 4) outcome= functional outcome of the patients according to its scale or sensory and motor outcomes. The first search was done using the keyword "whole body vibration". In PubMed it searched 2378 articles whereas in PEDro this term searched 392 articles and in TRIP database 1249 articles. The second search was done using the keyword "whole body vibration and chemotherapy" in the same databases. In PubMed it searched 50 articles whereas in PEDro it searched 3 articles and in TRIP database 1. The all gathered publications were then screened on the basis of inclusion and exclusion criteria. In the keyword searches, the publications having full length papers were included to make a pool for the systematic review. The studies were included if they were: 1) randomized controlled trial (RCT) 2) single group experimental study (crossover design) 3) pilot studies 4) publications in English language 5) described the effects of WBV in patients having chemotherapy and 6) used other techniques to compare the outcome of WBV. Then, a flow chart was design to elaborate the steps in the selection of the full papers and review (Figure 1)..

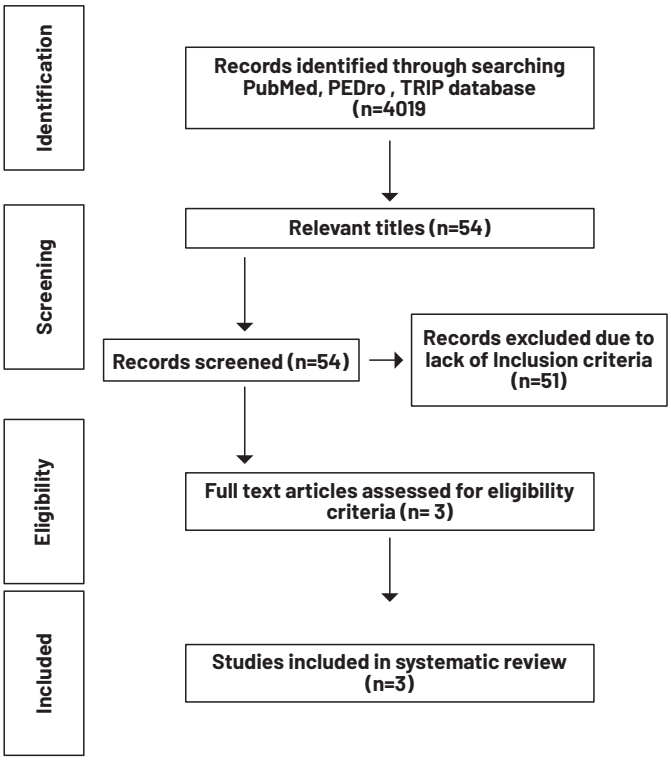

Figure 1: Prisma Guidelines Flow Chart for Literature Search and Study Selection

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Exclusion criteria was set according to which the articles were screened: Articles were excluded if they were: 1) published in any other language than English 2) other than experimental studies 3) with any other disease than malignancy 4) population having malignancy but not going through chemotherapy 5) studies on physiological phenomena 6) studies documenting effects on some specific limb or part of body and 7) duplicate papers. The studies on population other than going through chemotherapy was excluded as the purpose of this review paper was to evaluate the effect of whole-body vibration on the patients going through chemotherapy when they cannot continue their daily life activities due to weakness and fatigue leading to debilitating effects like bed ridden and bone loss. Despite seeing the effect on any one limb or specific part their overall functional outcome was assessed. The PEDro scale was used to classify the studies included in the systematic review. According to which three studies which has been included in the study has been ranked on the basis of score attained with 0-4 being poor, 5-6 being fair and 7 -10 being high. The Table 2 and 3 was drawn to check the methodological quality of the selected studies which is as follows.

Internal validity-statistical reporting	Streckmann F, Lehmann HC [17]	Pahl A [18]	Schonsteiner SS [19]
Random allocation	+	+	+
Concealed allocation	+	+	+
Baseline similarity	+	+	+
Subject blinding	_	_	_
Therapist blinding	_	_	_
Assessor blinding	+	_	+
Follow up>80%	+	+	+
Intention to treat analysis	_	_	_
Between group comparison	+	+	+
Point measures and measures of variability	+	+	+
PEDro scale	7	6	7
Eligibility criteria	+	+	+

Table 2: Methodological quality of studies included

Score	Classification
0-4	poor
5-6	fair
7-10	high

Table 3: Scoring and interpretation according to PEDro scale

So of the three studies, according to the scoring on PEDro scale one study is ranked fair wheras, two attained high score on it. The final levels of evidence and grades of recommendation for the effect of WBV on functional outcomes in patients having malignancies and going through chemotherapy are summarized in Table 4 below, using the grading system of the Scottish Intercollegiate Guidelines Network[20].

	Findings	Levels of evidence	Recommendations
Streckmann F, Lehmann HC	Positive effects	1++	A
Pahl A	Positive effects	1+	A
Schonsteiner SS	Positive effects	1++	A

Table 4: Quality of study according to PEDro Scale

RESULTS

The three studies were assessed to know their main findings. All of them showed the significant changes in the outcome of whole-body vibration and proved to be an alternative to the strenuous exercises which may cause health hazards to the patients going through chemotherapy. These findings are illustrated in Table 5 as follows:

Researchers	Study population	Intervention details	outcomes	Main findings
Streckmann F, Lehmann HC	Malignancy + chemotherapy	2 sessions for 6 weeks IG=patient standing on the vibration board with each session consisting of 4 progressing sets of 30 sec to 1min , with frequency from 18 to35Hz and amplitude of 2_4mm. 1 min rest interval between exercises. CG= balance exercises on uneven surface, 4 exercise per session with each exercise performed 3 times for 20sec, with a rest of 40 sec between each and 1min between each exercise.	Functional outcomes + sensory reflexes	WBV proves to be a good alternative treatment for the patients improving their sensory and motor symptoms.
Pahl A	Malignancy + chemotherapy	3 sessions per week, lasting 20 min IG=3 set of 2 to 4 exercises on Galileo sport vibration board for 30 to 60sec with 30 to 60 sec rest between exercise and 60 to 120sec between sets CG= aerobic exercise for 20 min with periods of rest	Functional performance	WBV proved to be a good alternative method to aerobic exercise during intensive chemotherapy to maintain patients' optimal functional status
Schonsteiner SS	Malignancy + chemotherapy	15 sessions on biweekly basis IG=in a warm-up season of 3 min, treatment was given with frequencies between 9 Hz and 13 Hz in a flat place of the assessment lounge chair (0° height). A short time later, the position was changed beginning with 30° height at a recurrence of 14 Hz and expanding to a rise of 60°-90° at a recurrence of 18 Hz (3 min). From that point, there was a	Functional performance + sensory reflexes	WBV proved to be significant protocol with respect to fitness, sensory function and functional outcome.

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		change in position i.e, 90° rise (up-right position) beginning at a recurrence of 19 Hz and expanded to a recurrence of 23 Hz (3 min). At long last, a cool-down stage (9 min) followed with lower frequencies of 9 Hz to 13 Hz diminishing from 30° height to a lying position to shield patients from muscle irritation. CG= training of posture and transport movements including 21 separate exercises		

Table 5: Data Extraction Table

DISCUSSION

The patients having any kind of malignancy and going through chemotherapy faces debilitating effects like peripheral neuropathy, pain, fatigue, weakness making patient bed bound leading to loss of bone mineralization and restricting their functional activities. During this phase patient cannot do intensive exercises due to high risk factors and negative effects on patient health. But when the whole-body exercise is introduced in the regime of such patients it has been seen that it reduces the debilitating effects without any changes in the vitals of the patient i.e., without increase in the blood pressure which was checked before and after the whole-body vibration maneuver. A similar study reported the effect of vibration training in reducing bone turnover in post-menopausal women without cancer and our results are in accordance with it [21]. Moreover, when the patients were assessed after the particular duration on the basis of time up and go test (TUG), 3-minute walk test and other balance scales they proved to perform better than patients who were only having placebo effects or no treatment at all or they matched the effects of patients going through strenuous activities providing an alternative regime for those who cannot do strenuous activities due to certain health hazards. Hence, it is proposed that whole body vibration at specific frequency increases the blood flow of the patient which in turn decreases the rate of bone loss or muscular atrophy in bed ridden patients or those patients who are not mobile to reduce the debilitating effects. This is in contrast with the study which does not report the effect of whole-body vibration program on bones of young heathy adults [22]. Moreover, it leads to activation of the motor units leading to neuromuscular facilitation which helps in gaining better static and dynamic balance and overall functional activity of the patient. These all effects are same as one doing any resistive or cumbersome exercise which is not feasible in such patients. Not only in malignancy patients, but also in elderly and healthy patients it has been proven that whole body vibration proves to be a safer and important technique by which the better outcomes in terms of functional activities can be gained. Although much work is being done on the importance of whole-body vibration but still there is long way ahead to go. As, there is no literature found which studied the effect of whole-body vibration on specific malignancy or compared its effect on different type of malignancies to see what are the confounding factors which effect the prognosis of the patient. Moreover, we need to study what is the minimum frequency and duration of the whole-body vibration that is required to gain the set outcomes.

CONCLUSIONS

The whole-body vibration is an effective technique to recruit the motor units and increase neuromuscular activity in both health and unhealthy people. It is considered to be safest technique which is acquired when the patient cannot do strenuous activities due to other risk factors as in patients going through chemotherapy, it reduces the debilitating effects by improving the balance, reducing pain and improving the functional outcome of the patients.

Authors Contribution

Conceptualization: WS
Methodology: WS, WJ, UF
Formal analysis: IA, FA
Writing-review and editing: AAA, MA, AI

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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