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Research Article

The Effects of Body Percussion Exercise on Balance in Older Adults

Mona Siminghalam[1], Hossein Alibakhshi[1], Negin Valikhani[2], Maryam Gholami[2], Mina Sadat Mirshoja[1*]

1. Department of Occupational Therapy, School of Rehabilitation Sciences, Neuromuscular Rehabilitation Research Center, Semnan University of Medical Sciences, Semnan, Iran.
2. Department of Occupational Therapy, School of Rehabilitation Sciences, Student Research Committee, Semnan University of Medical Sciences, Semnan, Iran.

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ABSTRACT

Introduction: One of the most complex problems of elders is the balance problem and the increased risk of falling. Body percussion is an effective treatment for various diseases with cognitive, physical, and psychological deficits and improves the memory, motor, and coordination skills, as well as the social interaction of patients with neurological diseases. One of the problems in the elderly is the weakness in balance skills and falling. This study aimed to investigate the effect of body percussion exercises (BPE) on the balance of the elderly.

Materials and Methods: This study was carried out as pretest-posttest research with two experimental and control groups. A 12-session therapeutic program was implemented 3 days a week each for 45-60 minutes. The subjects were evaluated using the Berg balance scale, functional reach, and timed up and go (TUG) tests. Data were analyzed by paired and independent t tests.

Results: The results of the treatment group showed a significant effect of BPE on the balance ($P<0.005$). A comparison of post-treatment results showed that the Berg balance scale ($P=0.00$), and timed up and go ($P=0.023$) were significantly different. The functional reach test ($P=0.174$) was not significantly different.

Conclusion: This study showed that BPE had a significant effect on the elderly`s balance.

*** Corresponding Author:**
Mina Sadat Mirshoja, Lecturer, PhD.
Address: *Department of Occupational Therapy, School of Rehabilitation Sciences, Neuromuscular Rehabilitation Research Center, Semnan University of Medical Sciences, Semnan, Iran.*
Tel: *+98 (912) 4921087*
E-mail: *msj5831@yahoo.com*

1. Introduction

One of the most complex problems of elders is the balance problem and the increased risk of falling [1] resulting from various reasons such as internal factors including dizziness, weakness in muscle strength, visual or cognitive impairment, and external factors such as poor lighting, insecurity, and slippery floors [2]. Improvement of walking and balance skills prevents secondary problems of falling, pelvis and extremity fractures, limitation of social participation, and dependency on daily life skills [3]. Balance is an essential requirement of everyday activities playing an important role in static and dynamic activities [4]. Duque et al. reported that poor balance increases the risk of falls in older adults [5]. Therefore, cognitive and motor interventions are necessary to improve the balancing ability of elders [6]. In another study, Van Diest et al. showed that poor postural control and balance problems led to a dependency on the daily activities of the elderly [7].

Body percussion is an effective treatment for various diseases with cognitive, physical, and psychological deficits [8]. This new practice within the Biomechanics, Anatomy, Psychology, Neuroscience, and Ethnomusicology (BAPNE) combines the effects of music and rhythmic movements leading to a connection between two cerebral hemispheres, the motor cortex, the cerebellum, and basal ganglia. The activity of these areas results in a more effective connection of cognitive functions (e.g., attention and working memory) and increased blood flow in the thalamus, insular, frontal, and parietal posterior cortices with motor areas related to motor function and balance [9]. This method is based on several different disciplines such as biomechanics (implementation of vertical, horizontal, and diagonal surfaces), anatomy (using upper and lower extremities), psychology (discovery of thoughts and feelings during the learning process), neuroscience (activating all lobes of the brain), and ethnomusicology (making culture-tailored sounds through the body) [10]. This method aims to develop each of the eight intelligences provided by itself [9]. In BAPNE, individuals use their bodies to create a sound, move in space, and always concentrate on their minds. Body percussion influences body awareness (the physical), concentration, memory and perception (the mental), and finally interpersonal relationships. Several studies have examined the effects of this treatment. Salmo et al. showed that the BAPNE program increases the ability to communicate with others and thus participate in activities and create a sense of belonging to the group [10]. Kavan's study examined the effectiveness of BAPNE on the cognitive skills of the elderly and showed that Kobe's body activates the cerebral cortex, establishes synapses, and ultimately learns movement [11]. In a study aimed at determining the research protocol and assessing attention, socio-emotional factors, and anxiety in high school students, Jimenez Molina et al. found that this treatment can be effective in increasing the motivation and participation of more people [12]. Tripovik et al. aimed at investigating neuromotor and cognitive rehabilitation of people with traumatic brain injury using the BAPNE method and found that their mood, behavioral, and motor disorders have improved [13].

The modern body percussion treatment using the BAPNE method in neurological rehabilitation improves the cognitive, memory, motor, and coordination skills, as well as the social interaction of patients with neurological diseases.

The world's population is rapidly aging and a large part of this change is taking place in developing countries [14]. This method follows the model of systems in motor behavior and emphasizes the interrelationship of individual factors, work, and environment and their effect on motor performance. It is safe to say that this study is the first research on the direct effect of Kobe body exercises on the balance skills of the elderly in Iran. Due to the novelty of this treatment, this study was conducted with the aim of the effectiveness of Kobe body exercises on the balance of the elderly in Iran to take a new step in the field of physical rehabilitation of the elderly and automate motor and balance skills and psychological skills such as emotion control.

2. Materials and Methods

This study was carried out as a randomized controlled trial with two groups (one intervention group and one control group) with the permission of the center management and the privilege of the Student Research Committee of Semnan University of Medical Sciences in the 277th Committee of Ethics of Semnan University of Medical Sciences proposed on February 6, 2018, and approved with the design number 1351, ethics (Code: IR.SEMUMS.REC.1396.217), and clinical trial (Code: IRCT20171219037954N2).

After receiving the code of ethics from Semnan University of Medical Sciences, written informed consent was obtained from all participants. The subjects were randomly allocated into either intervention or control groups. The intervention group received body percussion exercises (BPE), while the control group received

only routine daily exercises. Demographic information was taken from each participant before the beginning of treatment sessions. Study tools included Berg's balance scale (BBS), functional reach test (FRT), and timed up and go test (TUG).

The therapeutic interventions were then performed in 12-session program 3 days a week for 45 minutes for the participants as a group. The designed rhythms are taken from the twelve main notes of the music and are adapted to the Iranian culture. Two professional musicians have been used to do this. For each session, a specific rhythm is used, which is considered simple to advance from the first to the tenth session. The music is used from the third to the tenth session. Rhythms from the first to the tenth session are set at a speed of 60 meters. In the 11th and 12th sessions, the rhythms of the 9th and the 10th sessions are performed by increasing the speed from 60 to 70 to master the movements and rhythms. The first fifteen minutes of each rhythm training session is done by phone and imitating and producing sound in the hands, then the rhythms are done in a standing position to affect the balance. It should be noted that if a person needed to rest for any reason, the meeting was stopped for a few minutes and the participants had time to rest. Also, the participants in the control group benefited from conventional occupational therapy interventions.

The inclusion criteria included ages of 60-70 years [15], independent walking ability (10 m walk test) without assistive devices, records of one to three falls in the last six months, having a cognitive performance score higher than 21 in the mini-mental status examination (MMSE) test, having no chronic neurological, cardiovascular, orthopedic, and psychiatric disorder as reported by the patient, the family, or the physician, and a minimum education level of fifth elementary school. The exclusion criteria included hearing problems and lack of cooperation of the person participating in the treatment sessions. Data analysis was performed using SPSS software version 21 and paired and independent t-tests.

Outcome measures

Functional reach test

Dynamic balance was assessed by FRT. The FRT is a quick single-task dynamic test defined as the maximal distance that the subject can reach forward beyond arm's length while maintaining a fixed base of support in the standing position [16]. FRT is a valid, and reliable measure with an established sensitivity to change [17].

Timed up and go test

TUG is a valid, reliable, and simple test used to assess a person's mobility and requires both static and dynamic balance. It uses the time that a person takes to rise from a chair, walk three meters, turn around, walk back to the chair, and sit down [18].

Berg's balance scale

The BBS is used to objectively determine a patient's ability (or inability) to safely balance during a series of predetermined tasks. It is a 14-item list with each item consisting of a five-point ordinal scale ranging from 0 to 4, with 0 indicating the lowest level of function and 4 the highest level of function. This scale takes approximately 20 minutes to complete and it does not include the assessment of gait. The BBS is reliable (both inter-rater and intra-rater) and has concurrent and construct validity [19].

3. Results

In this study, 45 elderly (18 women and 27 mens) were randomly selected by convenience sampling method and were divided into two intervention and control groups. The mean age of the intervention group was 66.30 years with a cognitive level of MMSE 23.61, and the mean age of the control group was 67.55 years with a cognitive level of MMSE 23.74.

Table 1. Measures of dispersion in the pre-test groups

Variables	Mean±SD		P
	Intervention	Control	
BBS	49.22±3.11	47.86±3.06	1.000
TUG (second)	27.72±3.46	29.85± 3.20	0.582
FRT (cm)	19.545±2.72	18.695±2.85	0.272

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BBS: Berg balance test; TUG: Timed up and go test; FRT: Functional reach test; SD: Standard deviation.
P computed using α=0.05.

Table 2. Measures of dispersion in the post-test groups

Variables	Mean±SD		P
	Intervention	Control	
BBS	52.13±2.99	48.08±3.11	0.00
TUG (second)	25.04±3.81	28±6.41	0.032
FRT(cm)	21.09±3.9	19.21±3.51	0.174

BBS: Berg balance test; TUG: Timed up and go test; FRT: Functional reach test; SD: Standard deviation.

P computed using α=0.05.

The Kolmogorov-Smirnov test was used to determine the normality of the distribution of scores. Since the distribution of scores with a P<0.05 was normal; paired t tests were used to compare changes before and after treatment for each group, and an independent t test was used to evaluate the changes between the two groups. Investigating the interference of the intervention group and the control group in the pretest of the variables (TUG, FRT, BBS) showed that there was no significant difference between the groups in these variables (Table 1). Comparison of post-treatment results showed that the BBS (P=0.00), and TUG (P=0.023) were significantly different. The FRT (P=0.174) was not significantly different (Tables 1, and 2).

4. Discussion

The results of this study confirmed that BPE had significant effects on the balance skills in the treatment group (P<0.005). Also, the running speed of subjects in the TUG test increased and reduced the time (in seconds) to reach the goal. This number indicated that subjects with a lower average time were able to walk a three-meter path. Jimens Molina et al. showed that BPE influenced the development of motor skills and organ coordination, and even the superiority and dominance of organs [12]. Tripovik et al. found that the BAMPE technique supported the neuroplasticity theory and short-term nerve function reconstruction. This method introduced a new aspect of motor recovery in rehabilitation. The purpose of rehabilitation is firstly to fix the symptoms, prevent secondary injuries, and encourage patients to acquire new motor patterns [13].

Cavan studied the effectiveness of BAPNE on cognitive skills in the elderly and showed that body percussion caused the activation of the cerebral and cerebellum cortices, the creation of synapses and ultimately learning a movement. This involves the use of short-term memory, working memory, and thus activation of the prefrontal and cerebellum cortices. The parietal lobe is activated through physical contact, hearing sounds, and visual stimulation. The hippocampus is also constantly stimulated because it combines different sensory information. Targeted movements in the hippocampus reduce the pace of degenerative processes in Alzheimer. The prefrontal cortex is always active continuously as it coordinates working memory information, the language of stimulus selection, and sustained attention and can automate movement functions [20]. BPE is an effective therapeutic approach to various diseases with cognitive deficits, hyperactivity, and attention deficit hyperactivity [8]. It is necessary to identify the impacts and stimulation that occur in different areas of the cortical and subcortical areas on both hemispheres of the brain due to the interaction between the various elements on which the BAPNE method is based. Movements influence the motor cortex as well as the cerebellum and ganglion base. Songs effectively stimulate the right hemisphere, and within body percussion, various cognitive aspects are worked upon such as attention and memory, thus stimulating a variety of different areas. In particular, the attention levels seen within the learning process of the various movements lead to an enhanced level of blood flow in the pulvinar nuclei (thalamus), the basal ganglia, the frontal, insular, and posterior parietal cortices, as well as the nuclei of the anterior cingulate cortex. However, it is important not to forget the emotional aspects and their influence. While doing the activities in question, the emotions that are produced act as a source of support and motivation, which helps to increase the cognitive performance carried out [9].

One of the problems of this research was the poor collaboration of the elderly and the lack of incentives among some of them who were excluded at the outset of the study. However, their balance difficulties led to the fear of falling during training, which stopped the subjects from accuracy and agility during the exercises. It is, therefore, recommended that the exercises could be

designed from simple to complex based on the subjects' culture to improve their balancing skills in a standing position and during complex daily activities to diminish their fears. Also, the fear of falling among participants should be reduced by securing the treatment setting. The number of treatment sessions should be amplified with repetition and practice during longer times. Treatments with other assessment tools should be examined to further measure other agility and promptitude skills as well as other psychological and physical skills. If needed, larger sample size is also required in future studies.

5. Conclusion

This study demonstrated that BPE had a significant effect on the balancing and skills of the elderly leading to a new step in their physical and cognitive rehabilitation, besides helping the automatic implementation of motor and balancing skills.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of Semnan University of Medical Sciences (Code: IR.SEMUMS.REC.1396.217) and clinical trial (Code IRCT20171219037954N2). All ethical principles are considered in this article. The participants were informed about the purpose of the research. They were also assured about the confidentiality of their information and were free to leave the study whenever they wished, and if desired, the research results would be available to them. A written consent has been obtained from the subjects. Principles of the Helsinki Convention was also observed

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Authors' contributions

All authors contributed to designing, running, and writing all parts of the research.

Conflict of interest

All authors declare no conflict of interest.

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