Original Article

Physiotherapy and Occupational Therapy Journal
Volume 12 Number 4, October – December 2019
DOI: http://dx.doi.org/10.21088/potj.0974.5777.12419.1

Different Sizes of Swiss Ball for Balance Training in Geriatric Population

Akanksha Malhotra[1], Neha Gupta[2]

How to cite this article:
Akanksha Malhotra, Neha Gupta. Different Sizes of Swiss Ball for Balance Training in Geriatric Population. Physiotherapy and Occupational Therapy Journal. 2019;12(4):177–182.

Abstract

Background: Swiss ball exercise is used as a rehabilitative tool to correct posture and to treat and prevent pain in neck and waist, because it can increase muscle strength, endurance, flexibility, and coordination and be used to improve perceptual balancing ability. In the present study, we aimed to investigate the effects of activities on different sizes of Swiss ball on balance in geriatric population.

Method: In this experimental study 30 elderly people in the age of 65–80 years participated. Subjects were equally divided in 2 groups. Group A having 15 subjects are given Swiss ball exercises on 55 cm Swiss ball for 4 weeks (4 days/week). Group B having 15 subjects are given exercises on 75 cm Swiss ball for 4 weeks (4 days/week). Berg Balance Scale (BBS) scores were noted both before and after the 4 weeks exercises session on Swiss ball. Pre-exercise evaluation was done. Then the post-exercise evaluation was done. Subjects were evaluated using BBS.

Result: Thirty patients in the age range 65–80 years participated in the study. Patients were given Swiss ball activities. Within the group the pre-intervention BBS was 36.2 ± 5.11 and the post-intervention was 41.4 ± 6.32 (*t*-value is 3.25, *p*-value is 0.05) for 55 cm diameter Swiss ball. There is significant difference with in the groups with respect to mean BBS scores. Within the group pre-intervention BBS was 37.6 ± 5.40 and post-intervention was 45.6 ± 4.27 (*t*-value is 1.94, *p*-value is 0.05) for 75 cm Swiss ball. There is no significant difference with in the groups with respect to mean BBS scores. Between the two groups the post intervention BBS was 41.4 ± 6.32 the Swiss ball of 55 cm and 45.6 ± 4.27 for Swiss ball of 75 cm (*t*-value is 0.041, *p*-value is 0.05). There is no significant difference in the BBS scores.

Conclusion: There was positive improvement in Berg balance score by Swiss ball training on 55 cm diameter of swiss ball. There was no positive improvement in Berg balance score by Swiss ball training on 75 cm diameter of swiss ball. There was no improvements seen when both the Swiss ball regimes are compared.

Keywords: Berg balance scale; Central nervous system; Swiss ball; Balance; Geriatric population.

Introduction

Balance is the ability to keep the center of gravity on the base of support for static and dynamic movement. It is a complicated process involving sense, movement and CNS and their integrated coordination (B Young-Do-Seo et al., 2012). Balance is considered a key component in many activities of daily living, from simple activities such as quiet standing, to more complex activities such as walking while talking or while changing directions (Ayelet Dunsky et al., 2017).[6] Balance is defined as the ability to maintain one's equilibrium when one's center of gravity shifts (dynamic balance), as in walking and running, and when one's gravity remains stationary (static balance), as during standing or sitting (Myoung-kwon Kim et al., 2016).[9]

Performing strength exercises on Swiss ball has been advocated on the belief that a labile surface

Author Affiliation: [1]MPT Student, [2]Assistant Professor, Department of Physiotherapy, Amity Institute of Physiotherapy, Amity University, Sector 125, Noida, Uttar Pradesh 201313, India.

Corresponding Author: Neha Gupta, Assistant Professor, Department of Physiotherapy, Amity Institute of Physiotherapy, Amity University, Sector 125, Noida, Uttar Pradesh 201313, India.

E-mail: neha0628@gmail.com

will provide a greater challenge to the trunk musculature; increase the dynamic balance of the user. Stability is achieved through the co-activation of trunk muscles; therefore, endurance training has been postulated to be beneficial in training trunk muscles to provide stability (Bal BS, 2012).[1] Sensory information has an important influence on balance activity in older people, and integration of visual, vestibular and somatosensory information is necessary to generate appropriate balance responses (Narcis Gusi et al., 2012).[8]

Swiss ball exercises are used to strengthen the core abdominal muscles. Abdominal muscle endurance and strength are important for trunk stability, appropriate posture and body movements. The core is important because it provides proximal stability for distal mobility.

The Swiss ball can be used to promote balance in ADLs. Swiss ball exercises are widely used because they can improve strength, endurance, flexibility, coordination and balance (Wonjong Yu et al., 2017).[13] Swiss ball exercise is used as a rehabilitative tool to correct posture and to treat and prevent pain in neck and waist, because it can increase muscle strength, endurance, flexibility, and coordination and be used to improve perceptual balancing ability (Myoung-kwon Kim et al., 2016).[9]

Exercises conducted on uneven surfaces, such as swiss ball, can generate more activity then exercises on even surfaces and are effective for preventing musculoskeletal damage by improving dynamic balance (Myoung-kwon Kim et al., 2016).[9] Swiss ball activities requires more sense of balance and its positive effects are reinforcement of strength and endurance, increased joint flexibility, stability, coordination and sense of proprioception (Byoung-do-seo et al., 2012).[11] Most developed world countries have accepted the chronological age of 65 years as a definition of elderly or old age (Gaurai Gharote et al., 2016).[7]

Balance disorders generate a significant healthcare burden due to the rise in hospitalization morbidities, and mortalities in the elderly population. There are many factors that lead to balance disorders, including cardiovascular diseases, metabolic diseases, musculoskeletal disorders, neurological disorders, visual and hearing disturbance, fear of falling, surgical operations, and specific medications (Tahsin Baris Deger et al., 2019).[5]

All the aspects of health status., life style, life satisfaction, mental state or well-being. Together reflect the multidimensional nature of quality of life in an individual. Geriatric mental health problems with respect to the quality of life often remains neglected (Ankur Barua et al., 2007).[2]

Fall risk has been related to a number of factors such as history of falls, muscle weakness, gait deficit, balance deficit, use of assistive device, visual impairment, mobility impairment, fear of falling, cognitive impairment, depression, sedentary behavior, age, number of medications, nutritional deficits, urinary incontinence, arthritis, home hazards and footwears (Mona et al., 2018).[10] Maintaining balance without falling is essential for performing daily activities without injury. Impaired balance in elderly adults in general and in adults with intellectual disability (ID) in particular is problematic (Eli Carmeli et al., 2003).[3] The central nervous system and body proprioceptors work together to refine pattern of movement. Performing exercises on Swiss ball may increase proprioceptive demands and stress the muscles that are important (Garima et al., 2018).[4] The need for this study is that there are studies done on Swiss ball activities that has shown affect on balance in elderly population but there is no size comparison of swiss ball done on the population yet. This study is done to check which swiss ball gives better balance training to the population and is better adaptable to the population. Aim of the study is to observe the effect of size of Swiss ball on balance in geriatric population. Objective os the study is to compare the effect of Swiss ball activities of 55 cm diameter swiss ball and 75 cm diameter Swiss ball on balance in geriatric population as measured by Berg balance scale. Null hypothesis includes that there is no effect of sizes of Swiss ball on balance in elderly population. Alternate hypothesis includes that there is effect of sizes of Swiss ball on balance in elderly population.

Materials and Methods

The study design is experimental. The study population involved is geriatric population. The data was collected from Jain Neuro hospital, Karkarddoma. Thirty patients were selected on basis of onclusion and exclusion criteria. Selection criteria include inclusion criteria that include geriatric population, BBS score 30–45, age is 65–80 years, consent signed and are able to understand and execute the commands. Exclusion criteria includes physical activity dependent population (Fig. 1)

Independent variable is the Swiss ball exercises and dependent variable is BBS [reliability: Inter

rater reliability ICC = 0.87 (p <0.0001) construct validity = –0.53 (p <0.01)(Ching Yu Wang et al., 2006).[12]

Instruments required: Swiss ball (55 cm diameter and 75 cm diameter), stopwatch, balance berg scale (BBS), equipment required for testing are a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5 and 10 inches (5, 12 and 25 cm); chairs used during testing should be of reasonable heightn either a step or a stool (of average step height) may be used for item #12. Sampling involved is convenient sampling. Population is divided in 2 groups: group A involved the population that are given exercises on 55 cm diameter Swiss ball for 4 weeks (4 days/week) and group B involved the population that were given exercises on Swiss ball 75 cm diameter for 4 weeks (4 days/week).

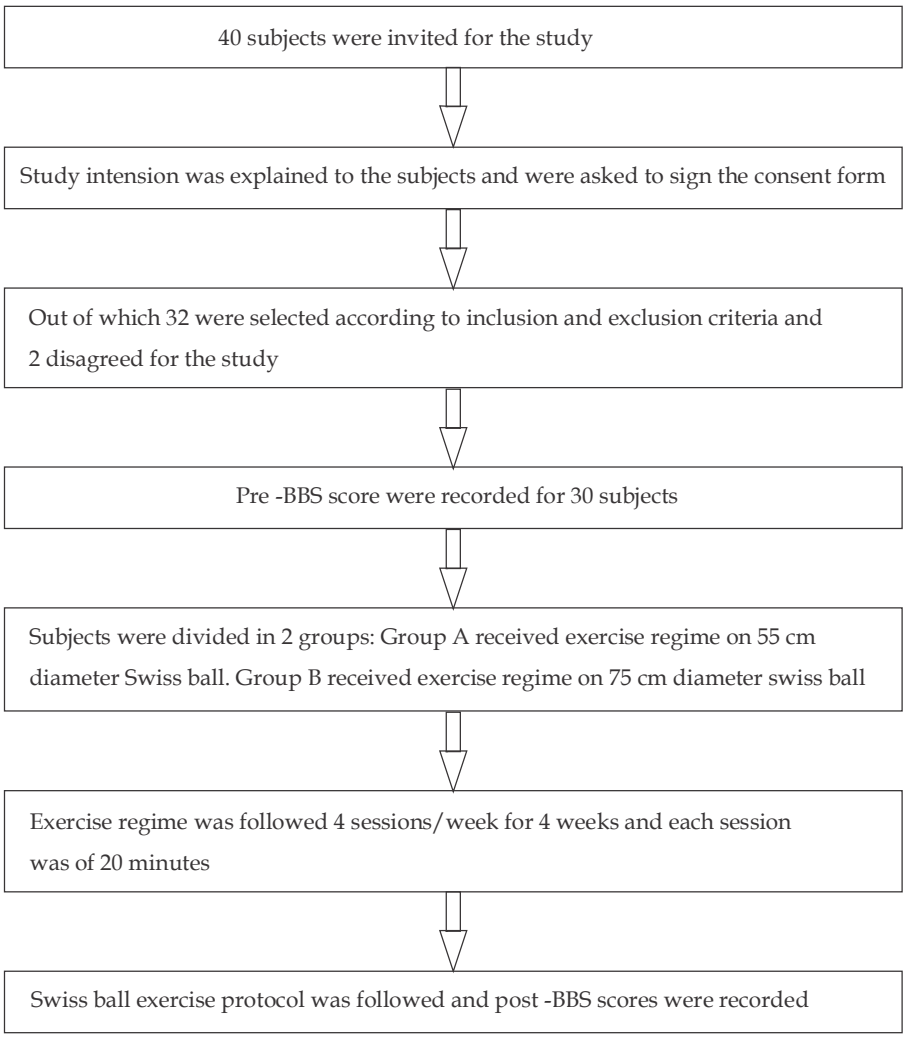


Fig. 1: Data flow diagram

Swiss Ball Training Protocols included

One set of trunk stabilization exercises composed of ten repetitions of four different routines. Ten sets were completed in each exercise session with a two-minute break between sets (1) A subject was asked to sit on a ball while lifting one or both arms (2) The subject sat on the ball with the feet (soles and heels) on the ground while bending the hip and knee joints at 90-degrees, and was then asked to maintain the trunk in an upright position for 20 seconds (3) The subject performed pelvic tilt (anterior/posterior, left/right) and rotation exercises (4) The subject placed the ball under his/hertrunk while in a four-point kneeling position and lifted the arms and legs in the following manner: Right arm with left leg and then left arm with right leg consecutively for five seconds (5) The subject in the prone position, the ball was placed beneath the feet and the hips were lifted for five seconds.

Results

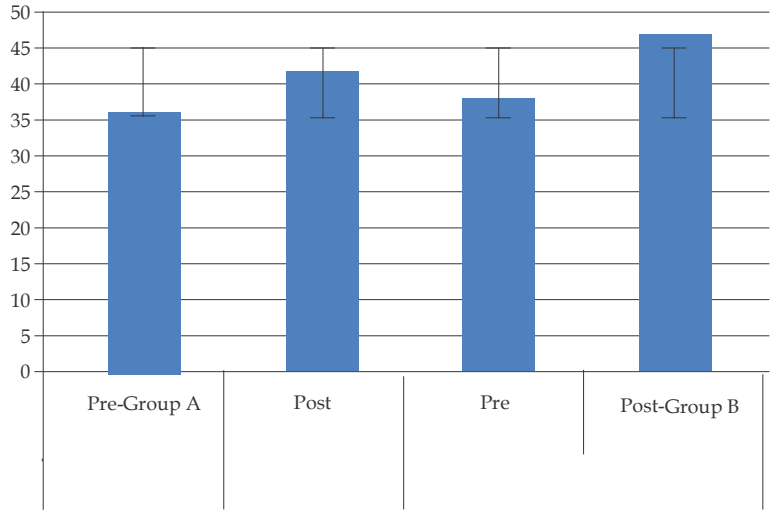
The data was entered and analyzed on MS Excel 2007 and then *t*-test was used to compare the difference of means between the group and within the group.

Used paired *t*-test with in the group because paired *t*-test is used to compare the means of two related groups to determine whether there is a statistically significant difference between these means.

Used unpaired *t*-test between the groups because unpaired *t*-test is used to compare the means of two unrelated groups to determine whether there is a statistically significant difference between the means of the two different groups.

The *p*-values for both paired and unpaired *t*-test is 0.05.

There were 30 patients (Age range: 65–80 years) who were enrolled on the basis that the odd ones are included in the Swiss ball prtocol on 55 cm diameter and even one are included in the Swiss ball protocol on 75 cm diameter. Patients were given swiss ball activities. Mean age 72.46 ± 6.70. Within the group BBS mean ± SD 36.2 ± 5.11 for pre and 41.4 ± 6.32 for post, *t*-value is 3.25, *p*-value is 0.05 for Swiss ball regime 55 cm. There is significant difference with in the groups with respect to mean BBS scores. The scores of BBS were significantly higher in post-exercise compared to the pre-exercise. Statistically there was a high significant difference between the pre-exercise and post-exercise of Swiss ball regime with 55 cm diameter. With in the group BBS mean ± SD 37.6 ± 5.40 for pre and 45.6 ± 4.27 for post, *t*-value is 1.94, *p*-value is 0.05 for Swiss ball regime 75 cm. There is no significant difference with in the groups with respect to mean BBS scores. The scores of BBS were significantly higher in post-exercise compared to the pre-exercise. Statistically there was a lower significant difference between the pre -exercise and post-exercise of Swiss ball protocol. Between the groups BBS mean ± SD 36.2 ± 5.11 for pre of Swiss ball of 55 cm and 37.6 ± 5.40 for pre of swiss ball regime of 75 cm, *t*-value is 0.47, *p*-value is 0.05. There is not a significant difference in the BBS score of the pre-conventional group compared to the pre swiss ball protocol group. Statistically pre swiss ball protocol regime is not highly significant as compared to pre-conventional therapy regime. Between the groups BBS mean ± SD 41.4 ± 6.32 for post of Swiss ball of 55 cm and 45.6 ± 4.27 for swiss ball protocol 75 cm, *t*-value is 0.041, *p*-value is 0.05. There is not a significant difference in the BBS score of the post conventional therapy regime group compared to the post Swiss ball protocol regime group. Statistically post Swiss ball protocol regime is not highly significant as compared to post Conventional therapy regime (Fig. 2).



p-value is 0.05

Fig. 2: Shows Comparison of BBS results of 2 sizes of Swiss ball Group A (55 cm Swiss ball) Group B (75 cm Swiss ball).

Discussion

In the current study there are improvements seen in balance when exercise regime was performed on 55 cm diameter Swiss ball. But there were no improvements seen in the balance when exercise regime was performed on 75 cm diameter and was no improvements e regimes were seen when both

the regimes were compared. These results obtained may be the results of the adaptability of the Swiss ball by the population.

There was a study that was conducted on the effect of 12 weeks of Swiss ball exercise protocol and this study gives the significant results on the elderly women on their physical fitness and balance ability. The study results showed the positive effects on the physical fitness and the balance ability of the older women.

There was another study that was done to see the effect of Swiss ball on static and dynamic balance. The results of the study were positive. there were improvements seen in the static and dynamic balance of the individual after performing the exercises on Swiss ball as to the persons who were not given exercises on Swiss ball. Swiss ball can be used to improve the static and dynamic balance of the individual and it can also enhance the concentration based performance for the individual.

One of the study showed that balance training decrease the fear of falling and improve the factors such as dynamic balance and the isometric strength in the individuals that are institutionalized older people. The results showed that the program was easy, affordable and effective as it improved the factors such as dynamic balance and isometric strength that were included as factors in the study that has to be seen effect on.

There was a study conducted that showed that taking balance training for older adults taken one step further resulted that is a description of the balance training this study shows that this balance training improved and strengthen the self efficacy in balance control that lead to the improved in the risk of fall, increasing the speed of walking, and also improved the physical function of the individual. The program was found motivating, valuable, fun and enjoyable for the individual that gives a result of high attendance for the study.

There was a study that shows the effect of core stability exercise that is done using the Swiss ball and how it effects the balance performance and quality of life of the elderly. The study concluded that use of exercise for the core stability gives much more effect than the floor exercises and improved balance in the elderly. The result of current study are related to the this study resulting in the improvements in the balance and the quality of life and administer a physical fitness program for the elderly can be taken into consideration and can be recommended to the individual. Considering the special conditions of the elderly both the types of the training.

Future scope of the study: There were no evaluation of activities of daily living that would show the improvements in the lifestyle of the population. The height criterion was not considered in the differentiation of the swiss ball sizes. There are certain limitations to the study that can be taken into considerations and further studies can be done that cope up with these limitations.

Limitations of the study: The small sample size that might have not given the actual results. There were no follow ups taken to study that is this treatment has the long-term effects on the patients activities. There were no evaluation of the activities of daily living that would show the improvements in the lifestyle of the population.

Conclusion

There was positive improvement in Berg balance score by Swiss ball training on 55 cm diameter of swiss ball.

There was no positive improvements in berg balance score by Swiss ball training on 75 cm diameter of Swiss ball. There was no improvements seen when both the Swiss ball regimes are compared.

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