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EFFECTIVENESS OF SWISS BALL TRAINING ON BALANCE IMPAIREMENT – A REVIEW

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Abstract:

Introduction/Background: Balance plays a crucial role in our lives and includes a major portion of ADL independently. With impairment in balance, it becomes a mandate to get it restored and correctly activated. Number of restorative techniques are underplay for balance whereas Swiss Ball use has been an important asset since Bobath period. Unstable and Unsteady surface plays a beneficial platform for gravity's role resulting in enhancing balance impairments.

Aims & Objectives: The main aim of the study is to investigate the effect of swiss ball training on balance impairment.

Keywords: Swiss-Ball, Balance, Co-ordination, GAIT, Muscle Strength.

Introduction:

Numerous functional (such as deficiencies in balance and strength/power performance), neurological (such as loss of sensory/motor neurons), muscular (such as atrophy of type-II muscle fibers in particular), and bone-related (such as osteoporosis) deteriorations are brought on by aging. In the past, lower extremity weight training and/or balancing exercises were utilized to address these age-related deficiencies. [(1)] The aging process causes deficiencies in both static and dynamic postural control, as well as a decrease in the capacity to produce maximal and explosive force. Age-related decreases in strength performance and muscle mass (sarcopenia) are specifically explained by a reduction in the number and size of type II fibers. The decreased number of muscle fibers appears to be caused by a number of denervation and re-innervation mechanisms. [(2)]

It has been demonstrated that functional limitations, as evidenced by metrics of lower extremity physical performance, are predictive of disability, the most distant consequence of disablement. [(3)] It has been shown that there is a curvilinear relationship between function as assessed by several physical performance measures and strength deficits. [(4)(5)]

It is believed that balance issues are frequent following a stroke, and they have been linked to a poor recovery in mobility and activities of daily living (ADL), as well as an elevated risk of falling.[(6)] Research on impaired balance has consistently demonstrated that stroke survivors exhibit more postural sway than healthy age-matched volunteers. Additionally, their weight distribution patterns have changed, distributing less weight through the weak leg and exhibiting smaller excursions when shifting their weight around the base of support, particularly in the weaker leg's direction. This pattern is observed in all domains of balance, including static, dynamic, and reactions to external disturbances. Individuals with high

function after a stroke, such as those who are ambulatory in the community, also exhibit this pattern.[7,8]

It's possible that balance deficits have nothing to do with daily functioning or balance disabilities. The discovery that balance impairments do not improve with time after a stroke or during therapy, despite improvements in balance disability and function, supports this theory.[9] Particularly in the first three months following a stroke, there is evidence of a true physiological recovery of paretic leg muscle functions in postural control. Significant balance recovery also happens in patients in whom there are no discernible improvements in support functions or equilibrium reactions mediated by the paretic leg. It's likely that this kind of rehabilitation takes much longer than three months. It appears that standing balance recovery in patients following a major stroke may be determined by factors other than the restoration of paretic leg muscle functioning.[10]

Compared to generic, nonspecific techniques, multicomponent exercise programs that explicitly address the physical deficits of older adults based on a therapist's evaluation are more effective in fostering enhanced strength, balance, and fall prevention. More immediate benefits will come from this customized strategy, whether it is carried out at home or in a medical institution under the direct supervision of a rehabilitation clinician. Additionally, this might enhance the sustained adherence required for long-term fall prevention, balance enhancement, and physical function optimization in older persons. [11]

The Swiss ball is an extremely affordable equipment that is useful for all areas of physical therapy. Clinical objectives include stimulating the brain's afferent pathways for patients receiving treatment at home, in outpatient clinics, and in critical care units of hospitals. It is useful in assessing patients' total strength and competence and can be used to train and assess balance and coordination.When weak or partially paralyzed, the Swiss ball lessens the amount of body weight a patient must raise. If a partially paralyzed limb is lying on a ball, the force of gravity is lessened, allowing a weak patient to potentially move the leg.[12] However, performing exercises on an unstable surface, when compared to a stable surface, arouses a greater influence on muscular activity and unstable surface training can be very effective for injury prevention and treatment.

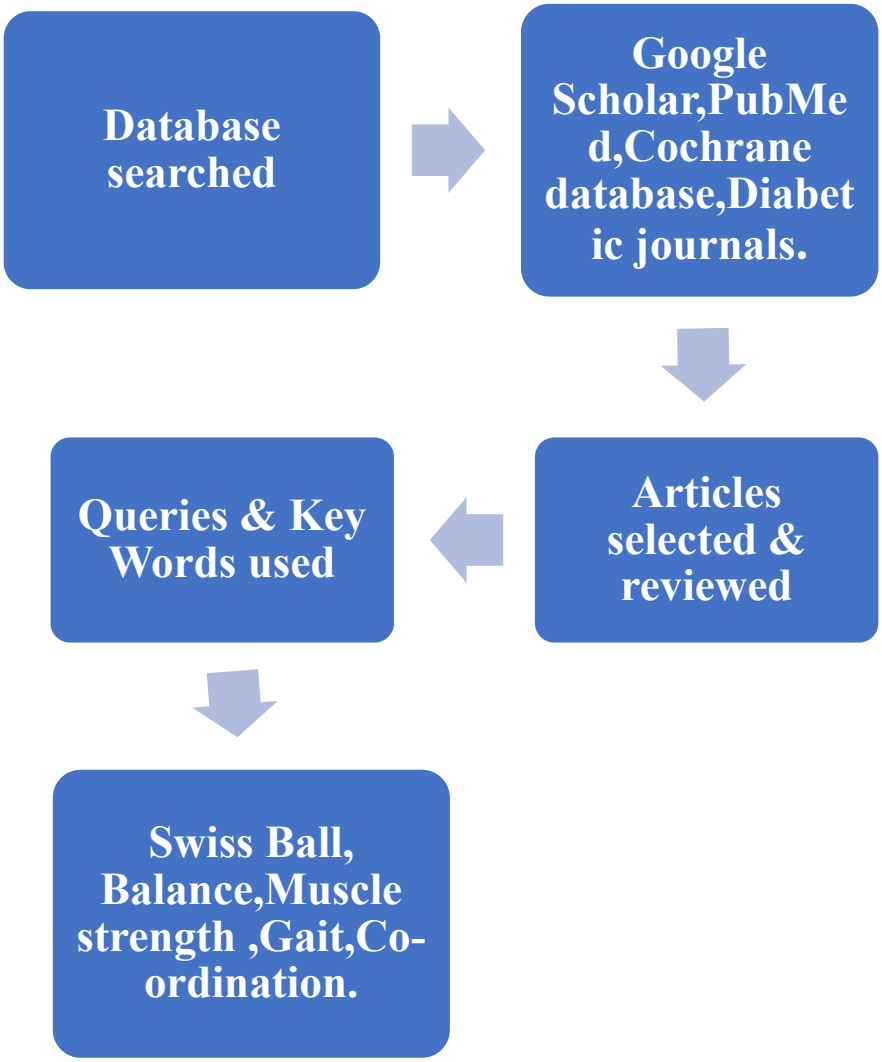
Conversely, Swiss ball exercises decrease force output when compared to a stable surface. [13] A study showed that the cross-sectional area of Lumbar Multifidus rose as the surface's lability increased, indicating that Swiss Ball was superior to a non-labile surface at promoting Lumbar Multifidus activity. This supports the use of a labile surface in spinal rehabilitation and validates existing clinical practice .[14]

This review focuses at detailing the effects of Swiss Ball on balance, Co-ordination and further flexibility in individuals and its significance with better understanding, crucial roles being played by swiss ball in managing balance disorders and associated conditions.

Aim: This review aims at studying relation between swiss ball on its effect balance training.

Objective: Objective of this review is to assess the effects of swiss ball on balance training.

Methodology:



An electronic database search was conducted between year 2010 to 2023 by using Google Scholar, PubMed, Cochrane, Physiotherapy journal, Journal of balance and training. The study was double checked and only full text articles were used for the review. Total 12 studies were selected for the study of Swiss Ball and balance training. This study was ethically approved by ethical committee (BMU/FTP/206). The study is descripted further.

Authors/year	**Study design** **Sample size**	**Duration**	**Assessment measures**	**Result**	**Conclusion**

Yong-Jin Seo, Yong-Seopoh (2016)[15]	RCT N=30 (EG=15) (CG=15)	5 Weeks, (5 d/w)	Trunk Impairment scale, Postural assessment scale-stroke (PASS), Trunk control test (TCT), Postural Sway accelerometer	Value of p came out significant with 0.000 and level of significance was p<0.05respectively.	Swiss ball exercises provided beneficial effect on trunk ability and postural sway in stroke.
Nadia Gul, Sara Mumtaz et al, (2021)[16]	RCT N=40 EG=20 CG=20	3 weeks (4 d/w)	Berg Balance Scale, Trunk impairment scale	Value of p came out significant with p= 0.000 where as level of significance was <0.05.	Swiss ball exercises performed post stroke results in improved better balance and posture stability.
Risfandi Setyawan, Hari Setijono et al (2021) [17]	QES N=80 (EG=40) (CG=40)	10 Weeks	Balance beam test, Sit & reach test, Leg dynamometer, Partial curl up, Bench Jump	Result came out to be significant with overall significance of p=0.026, p= 0.023 whereas level of significance was p<0.05	Study concluded that floor & Swiss Ball aided exercises training were effective in balance, flexibility, Strength & endurance.
Su Young Kim, Jeon yeon Hong et al (2021) [18]	RCT N=24 (EG=12) (CG=12)	3weeks (5d/w)	Sit & Reach, Stabilizer leg lowering test, Balance error scoring system & Y- Balance test	Result came out to be significant with value of p=0.006, 0.022,0.28 & 0.97 respectively with level of signifance at p <0.05.	Study concluded that Swiss ball and pelvic compression belts are effective in balance, flexibility & muscle strength.

Preeti Gazbare, Tushar Palekar (2014)[19]	Pre-poststudy. (N=30) (EG=15) (CG=15)	4Weeks (3d/w)	Berg Balance Score	Result came out to be significant with value of EG p<0.002&0.001 respectively with level of signifance at p <0.05.	Study concluded that Swiss ball had an additional effect in improving balance in hemiplegia.
Henny Syapitri (2016)[20]	QES (N=172)	4Weeks	Respondence characteristics, Berg Balance Scale	Result came out to be significant with overall significance of p=0.000, whereas level of significance was p<0.05	Study concluded that swiss ball is effective in improving body balance to reduce risk of fall.
Yun-Jeong Lim, Soon Hee Kang (2021)[21]	Pre-Post study (N=21) (EG=7, WSB) (EG=7,W/O SB) (CG=7, NP)	4 Weeks	Portable muscle strength measurement, Berg Balance Scale, G-Walk & Korean falls efficacy Scale(K-FES)	Result came out to be significant with p=0.018 for strength=0.017 balance=0.018 gait & p= 0.018 for fall efficiency respectively with level of significance p<0.05	Study concluded that lower extremity exercises, with or without swiss ball could be effective intervention in improving muscle strength, balance, gait & fall efficacy in stroke.
Su-Hee Choi, Jae-Heon lim et al(2012)[22]	Pre-Post Study. N=19 (SBG=10) (CSG=9)	4Weeks (3d/w)	Functional reach test,one leg stand test open& closed eye, timed up & go test, 6M walk test	Result came out to be significant with p=0.000,0.004,0.151, 0.000&0.006 respectively with level of p at <0.05 for significance.	Study concluded that trunk stabilization exercises using swiss ball could improve balance & gait in elderly women.

M young Kwon Kim, (2016)[23]	Pre-Post Study (N=20) (EG=10) (CG=10)	4Weeks (5d/w)	Velocity movement distance (Ant-Pst, Lt-Rt)	Result came out to be significant with p=0.00, respectively with level of p at <0.05for significance	Study concluded that exercises with blind fold stimulates other senses by blocking visual information& improves balance ability.
Byoung-do soe, Young dea-yum et al ,(2012)[24]	Pre-Post study (N=65) (EG=38) (CG=40)	12 Weeks (2d/w)	Sit to Stand, Arm curl , Sit & Reach ,Back Scratch, One legged Standing time, Timed up & go test.	Result came out to be significant with p<0.01& p<0.001 physical fitness, p<0.01 & p<0.001 for balance ability	Study concluded that physical fitness and swiss ball had a positive effect in fitness and balance ability in elderly women.
Gui Bin Song, JwaJun Kim et al (2015)[25]	Pre-Post Study (N=40) (SEG=20) (REG=20)	8 Weeks (5d/w)	Weight Distribution, Sway area, Sway length, Sway speed, Limit of Stability	Result came out to be significant with p=0.00, respectively with level of p at <0.05for significance	Study concluded that Swiss ball exercise & resistance exercise is effective on balancing ability of scoliosis patient.
Sekendiz, Betul et al (2010)[26]	Pre-Post Study (N=21)	12Weeks (3d/w)	Biodex isokinetic dynamometer, Curl Up test, Repetitive squat test ,Sit & Reach test , Functional reach test.	Result came out to be significant with p=0.001 dynamic balance, respectively with level of p at <0.05for significance	Study concluded that Swiss ball is effective in dynamic balance, muscle endurance & flexibility.

RCT- Randomized Control Trial, EG-Experimental group, CG-Control Group, QES -Quasi Experimental Study, WSB- With Swiss Ball, w/o SB- Without Swiss Ball, NP-Normal Patient,

SBG-Swiss Ball Group, CSG-Core Stabilization Group, SEG- Swiss Ball Exercise Group, REG-Resistance exercise group.

Material and Method: An electronic database search was conducted between year 2010 to 2023 by using Google Scholar, PubMed, Cochrane, Physiotherapy journal, Journal of balance and training. The study was double checked and only full text articles were used for the review. Total 12 studies were selected for the study of Swiss Ball and balance training

DISCUSSION

Risfandi Setyawan, Hari Setijono et al conducted a study in year 2021 where they conducted an quasi experimental study showed that the floor exercise program and the Swiss ball exercise leads to adaption. Joints with more integrity and muscles with balance, strength, and flexibility are less likely to sustain injuries. As a result, the muscles around the joint have a tendency to place a higher priority on stability than on power output. When comparing the Swiss ball group to the floor exercise and traditional groups, a noticeable improvement were seen because of lower contact area, more activity disruption from shaky surfaces, and control of the center of gravity at body areas with less base support from Swiss balls instability.[3]

Another study conducted by Su Young Kim, Jeon yeon Hong et al in year 2021 stated that performing the Swiss ball exercise after wearing a pelvic compression belt, flexibility increases as strength increases, Swiss ball exercise while wearing a pelvic compression belt is useful for improving flexibility and back strength.

One more study conducted by M young Kwon Kim in year 2016 stated that Swiss ball exercise program had a positive effect on balancing abilities and physical fitness in elderly. This works as preventive measure for fall prevention and health promotion. They also stated that with duration of 8 weeks or above improves physical fitness and balancing of elderly. With available data proving the effect of swiss ball on balance , co-ordination and strength associated with it , it forms a clear angle of positives effects and significance of swiss ball in improving balance. This review supports swiss ball usage for improving balance.

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Result: According to data search on July 2024 from January 2010 to April 2023 about 12 free full articles shows the positive effect of swiss ball training on balance impairment.

Conclusion: This review study concluded that Swiss ball training had a significant effect on improving balance impairment. This review concludes that Swiss Ball has a significant impact in improving balance. Swiss ball's usage in elderly , stroke caused balance impairment , age related muscular weakness is beneficial and significant.

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