Original Article

Effects of Sensory Motor Training On Balance and Proprioception among Post-Menopausal Obese Women

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ABSTRACT

Objective: To determine the impact of sensory motor training on balance and proprioception among postmenopausal obese women.

Study Design: Interventional randomized clinical trial

Place and Duration of Study: This study was conducted at the THQ hospital Faisalabad from September 2020 to March 2021 for a period of six months.

Materials and Methods: A convenient sample of 40 postmenopausal obese women with age range 45-65 years were included after obtained informed consent and randomly divided into two equal groups. Group A (n=20) was received sensory motor training along with conventional therapy while group B (n=20) was only given conventional therapy. The interval of training was 6 weeks. Both groups were assessed by using functional reach test (FRT), time up and go test (TUG) and one leg stance test (OLS) at baseline and 6th week (pre- and post-estimation of postural strength). Values were obtained after intervention analyzed for any change using SPSS 25.

Results: The results of this study found that SMT exhibited significant improvement in FRT score in Group A as compared with Group B at post-test, 11.35±1.34 vs 10.35±1.30 (p=0.022) respectively. TUG score significantly lower in Group A as compared with Group B, 9.00±1.52 vs 10.75±1.61 (p=0.001) respectively and proprioception OLS significantly increased with DO, 25.01±2.69 vs 22.46±2.27 (p=0.003), DC 6.54±.73 vs 5.99±.84 (p=0.034), OO 20.06±1.18 vs 17.61±1.28 (p=0.0001) respectively but non-significant increase in OLS with OC 3.49±.72 vs 3.09±.71 (p=0.089) respectively.

Conclusion: This study concluded that sensory motor training show improvement in balance as well as proprioception. Static and dynamic balance indicated more improvement in sensory motor training when compared with conventional training while proprioception demonstrated almost similar outcomes for the both groups.

Key Words: Menopause; Obesity; Postural balance; Proprioception; Sensory motor training

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INTRODUCTION

The most frequently used definition of natural menopause is amenorrhea for 6 continuous months without hysterectomy.[1] Postmenopausal women may have postural changes, for instance, forward head, changed shoulders, extended kyphosis, diminished lumbar lordosis and flexed hips just as, knees.[2]

These progressions might be because of loss of flexibility in connective tissues, lessened capacity to neutralize gravitational powers and decrease of muscles strength just as, endurance.[3] All of these postural changes influence day by day living exercises, equilibrium and walk, henceforth; increase the high fall risk.[4] It is accepted that estrogen may avoid fractures by reducing bone loss, motivating postural balance, increasing well-being and minimizing sleep disturbances thus, decreasing the risk of falling.[5] Loss of estrogen during menopause may impair protective reflexes,[6] as well as increase bone resorption leading to faster bone loss which is a foremost risk factor for decline in postural balance and fracture.[7]

Menopause is also accompanied by reduction in resting metabolic rate, physical activities and energy expenditure leading to obesity[8]which is usually represented as an increase in fat mass and abdominal adipose tissue accumulation.[9] Obesity is linked with an infinite list of diseases such as diabetes, hypertension, chronic heart diseases, stroke, osteoarthritis and sleep apnea.[10]

Balance is a complex process in which the support of a position is controlled by postural changes in accordance with intentional movement and because of outside

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bother.[11] Balance training and individualized muscle strength programs bring about wide scope of advantages. These incorporate less fair of falling, prevent moderate wounds, and improve muscle strength and postural balance just as, keep up actual work level.12 Balance is characterized as, the capacity to keep up the body's focal point of gravity (COG) over its base of help (BOS) .[13]

The proprioception is a nature of the somato sensibility that can be characterized as the view of body and segment position as for the space, or of each portion of the body as for the body itself. Proprioception is a complex sense contributing to muscle sense, joint stability, and postural equilibrium. This occurs through mechanoreceptors located in the muscles, ligaments, tendons, joint capsules, and skin. In this manner, proprioception has been characterized as a person's capacity to incorporate the sensory signals from different mechanoreceptors to consequently decide body position and developments in space.[14] Sensorimotor training (SMT) is a distinct type of proprioceptive and balance exercise that was planned for management of patients with chronic musculoskeletal problems (e.g., pain syndrome). The impression on which it relays that instead of focusing the isolated strength of a group of muscles around a joint. Sensorimotor training involves help of sensory data sources (proprioception and somatosensory sources of info, remedying muscle imbalance and guaranteeing right pattern at the degree of focal sensory system.[9]

The rationale of this study was to assess the effect of sensorimotor training in post-menopausal obese women to improve balance measures and proprioception, before and after training.

MATERIALS AND METHODS

An interventional randomized clinical trial (Registration number: Clinical Trials.gov Identifier: NCT04820738) was conducted at THQ Hospital Faisalabad, from September 2020 to March 2021. Ethical approval was gained from institutional review board (IRB) committee of Riphah International University Lahore campus as well as from the hospital. The sample size was calculated by WHO sample size with following parameters; the mean body mass index (BMI) in control group 24 kg/m^2 and in experimental group was 26 kg/m^2, confidence interval (CI) 95%, and power of test was 80%.[10] 40 postmenopausal women who met the inclusion criteria and entered the trial with non-probability consecutive sampling technique. Women between the age of 45-65 years with post-menopause obesity, BMI $\geq$ 30 kg/m^2 at assessment with independent in daily living activities (ADLs), self-ambulatory, and healthy women (having no known condition in which sensorimotor training would be contraindicated) were included in the study. Women having history of ankle sprain, uncontrolled diabetes mellitus, psychological and cognitive problems, women with severe visual impairment and retinopathy, women with other medical complications foot ulcers, orthopedic or other neurological impedance (e.g., neuropathy, major vascular problem, inability to walk independently with or without an assistive gadget), also Covid-19 positive findings on PCR were excluded from the study. The researcher thoroughly gone through the case history and detailed examination. Women were equally allocated (each group=22) in experimental (A) and controlled (B) groups via computerized method. Randomization sequence computer-generated numbers by a biostatistician and allocation was sealed in opaque envelopes to ensure concealment. The data was gathered on structured questionnaire, "Functional reach test (FRT)", "Time up and go test (TUG)" and "One leg stance test (OLS)" as subjective measure. Controlled group was given conventional treatment that includes dietary guidelines (cutoff fat foods, plenty drinking water, low sugar and salt in meal, eat fruits and vegetables, took calcium iron and fiber diet), walking treadmill for 15 mints, stairs climbing and balance exercises on gym ball. While the experimental group was given dietary guidelines, treadmill walking for 15 mints and the intensity of 50%–60% HRmax, where HR max=206.9−0.69 × age (years) included in warm up session, "sensorimotor training" included wall slide, core exercises (planks, leg raises, crunches, bridging), and balance exercises (single leg side lift, leg lift with dumble, balance on stability gym ball) on unstable surface for 15 minutes (3 sets of 10 rep) of exercises and gait training (different patterns of walking). Exercises included for cool down 5–10 min of profound breathing, abdominal breathing, and slight stretching for both groups.[15]The workout was directed thrice a week for 6 weeks. Data was collected at baseline (initial assessment), then at 6th week post treatment. Balance and proprioception were reassessed on FRT, TUG, and OLS.

By following CONSORT guidelines final analysis done with 40 patients, 20 in group A and 20 in group B. Data analysis was completed with SPSS version 25. The normality of the data was assessed by Shapiro-Wilk's test of normality and uniformity.

RESULTS

Table No.1: The Demographic data of both groups, n = 40

	Mean± S.D
Age (years)	50.27±3.17
Weight (kg)	82.57±8.64
Height (meter)	1.47±0.12
BMI (kg/m^2)	33.95±2.03

The total number of patients was 40 with 20 in each group. The mean age of participants was 50.27, weight

was 82.57kg and height 1.47 in meters. The average BMI was estimated to be 33.95 which fall under the category of obesity. The demographic characteristics of patients were studied (Table-1).

Shapiro Wilk test was applied as test to check the normality of data and found all the data was normally distributed as p value was >0.05.

Table No.2: Between group Comparison of FRT, TUG and OLS scores at baseline and at 6th week

Functional reach test (FRT)	Sensorimotor training	Conventional training	t*	p-value
	Mean±SD	Mean±SD		
At baseline week 0	7.65±1.26	9.00±1.68	-2.862	.007
End of treatment week 8	11.35±1.34	10.35±1.30	2.380	.022
Time up and go test (TUG)				
At baseline week 0	12.60±1.72	12.65±1.78	-.090	.929
End of treatment week 8	9.00±1.52	10.75±1.61	-3.523	.001
One leg stance (Dominant Leg Eyes Open) score				
At baseline week 0	16.56±2.46	18.24±2.62	-2.091	.043
End of treatment week 8	25.01±2.69	22.46±2.27	3.236	.003
One leg stance (Dominant Leg Eyes Closed) score				
At baseline week 0	5.63±.73	5.77±.77	-.617	.541
End of treatment week 8	6.54±.73	5.99±.84	2.199	.034
One leg stance (Other leg eyes open) score				
At baseline week 0	15.39±1.06	15.34±1.14	.141	.888
End of treatment week 8	20.06±1.18	17.61±1.28	6.270	.0001
One leg stance (Other leg eyes closed) score				
At baseline week 0	2.87±.67	2.99±.75	-.520	.606
End of treatment week 8	3.49±.72	3.09±.71	1.748	.089

*: Independent sample t test

DISCUSSION

The current study analyzed proprioceptive balance among sensorimotor training and conventional therapy in post-menopausal women. Sensorimotor training presented significantly increased in TUG, FRT and proprioception regardless of BMI, while One Leg Stance (Eyes Open and Eyes Close) in conventional therapy indicated essentially more modest changes when compared with sensorimotor training. The results of this study found that sensorimotor training group showed greater improvement in Functional Reach test score in participants of Group A after compared with participants of Group B. While TUG grade fundamentally reduced in Group A after in comparison with Group B and proprioception. Previous studies results showed at 6, 8 and 12 weeks of balance activities, and improvement in balance (TUG, FRT) and walk over a beam.[16,17] Richardson JK, et al.,[18] conducted a study and revealed that no improvement after 3 weeks of balance training. The majority of the participants of both groups (A & B) in present study had Time Up and Go test in the range of 9.00 and 10.75s respectively. TUG score ≤ 10s shows low fall risk, and ≥14s demonstrates high fall risk. Although through assessment of fall was not ended, the activities decreased the risk of fall in post-menopausal obese women.

In present study maximum participants of both groups had FRT estimation of 11.3 inches and 10.35 inches respectively at the end of treatment. FRT score of 6 or less illustrate a critical expanded higher fall risk. A score between 6-10 inches demonstrates a moderate fall risk, and a score more than 10 inches shows the generally low fall risk. The present study investigated static balance by assessing One Leg Stance with eyes open and eyes close state in the two legs, therefore balance and proprioception improvement significantly smaller changes. The results showed significantly increase in one leg stance (OLS) with eye open (EO) dominant leg eyes open and other leg eyes open (DO & OO) and eyes closed (EC) dominant leg eyes open (DO) yet non-significant increase in OLS, other leg eyes closed (OC) in post-menopausal obese women.

Lee K, et al.[19]similarly reports increase in OLS after balance training. OLS and FRT showed significant improvements in interventional group ($p < 0.05$) but not in the control group after balance training. Kruse RL, et al., [20] didn't locate any significant changes after intervention. Rojhani-Shirazi Z, et al., [21] study showed OLS with eyes open and close in the two different kinds of balance training. OLS (dominant and other leg) with EO and EC significantly improved in both treatment groups from pre to post-test ($p \leq 0.001$). However, in control group no significant changes found in OLS with closed and open eyes. Improved OLS with EO and EC found in both legs with two different types of balance training. Ahmed I, et al., [22] study on diabetic peripheral neuropathy patients, balance (static and dynamic) actions progressed with sensorimotor training following two months. Static balance shows more prominent improvement in the moderately elderly than more age group, whereas proprioception and dynamic balance

demonstrate comparable improved within the participants of both age groups.

Song CH, et al., [17] study claimed development in trunk proprioception following a month and a half of equilibrium training in postmenopausal women. In the exercise group functional reach test score significantly improved ($P < 0.01$). However, no significant difference was seen in the FRT score in control group. TUG time in the exercise group significantly decreased ($P < 0.01$). In the control group TUG score no significant difference was seen in pre- and post-testing**.**

CONCLUSION

This study concluded that exercise intervention sensorimotor training improved balance (static and dynamic) over and above proprioception actions. Static and dynamic balance indicated more prominent improvement in sensorimotor training group when contrasted with conventional therapy in post-menopausal obese women while proprioception demonstrated comparative outcomes for both treatment protocols.

Author's Contribution:

Concept & Design of Study:	Binash Afzal
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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