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Effect of postural breath technique (PBT) compared with postural stretching technique (PST) on body flexibility in healthy participants with poor flexibility: A randomized controlled trial

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ABSTRACT

Background: Body flexibility is essential in sports science, enhancing athletic performance by improving agility, balance, and coordination. Postural muscles serve postural control and breathing and are crucial in biomechanics and neurophysiology. The postural breath technique, an exercise combining breathing and postural muscle engagement, was designed to enhance flexibility.

Objective: This study compared the effects of postural breath technique (PBT) and postural stretching technique (PST) on body flexibility in individuals with poor flexibility.

Materials and methods: Fifty-eight participants with poor flexibility were randomly divided into two groups. They received a supervised exercise program of either PBT or PST twice weekly for four weeks. Outcome measurements, including Sit and Reach Test (SRT) as the primary outcome, Modified-modified Schober Test (MMST), Passive Knee Extension Test (PKE), and Craniovertebral Angle Test (CVA) as secondary outcomes, were conducted at baseline, immediately after the first session, and after the last session.

Results: Within each group, both PBT and PST significantly increased SRT scores, decreased PKE angle on both sides and improved MMST and CVA. The mixed-model ANOVA revealed significant differences within groups at each assessment point. PBT resulted in immediate and after four weeks improvements in SRT, MMST, PKE, and CVA, while PST showed increased of all outcomes after four weeks. However, there was no significant difference between the PBT and PST groups.

Conclusion: Both PBT and PST demonstrated effectiveness in improving general body and hamstring flexibility. The study's results suggest that clinicians determine the most effective approach for everyone, such as immediate flexibility improvements (PBT) or sustained flexibility gains over time (PST).

Introduction

Flexibility is essential to health and physical fitness, beside muscle strength and body stability.[1] It significantly influences one's ability to perform daily, athletic, and leisure activities. Optimal flexibility contributes to improved performance, while poor flexibility increases the risk of muscle injuries.[2] Many previous literatures emphasize the various aspects of flexibility, particularly in the spine and hamstring muscles, which are related to overall musculoskeletal health.[3,4] The spine's flexibility directly influences the performance of the abdominal muscles.[5]

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Deep breathing enhances the mobility of the thoracic spine and rib cage, thereby indirectly improving overall flexibility.[5] Proper breathing patterns can facilitate better oxygenation of the muscles, reduce tension and enhancing muscle pliability, which is essential for flexibility. The correlation between breathing and flexibility is also evident that controlled breathing can lead to greater muscle relaxation and an increased range of motion.

Postural muscles, which maintain an upright body position against gravity, play in postural control and breathing.[6] These muscles divided into local and global groups, provide stability to lumbopelvic hip complex and support the spine and pelvic during functional activities.[7] Poor flexibility and posture, often due to the inadequate functioning of these muscles, can negatively impact of joint structure, especially in the spine and knee. [8]

The connection between postural muscle and breathing is crucial, as these muscles support the integrity of the breathing mechanism. The diaphragm, a core stabilizer muscle, is closely linked to both postural control and breathing.[6] Ineffective diaphragm function can disrupt breathing patterns, leading to poor balance and compromised postural control.[9] When the diaphragm's function is impaired, chest mobility decreases, limiting deep breathing[10] and reducing flexibility, particularly in the upper body.[11]

Core stability impacts flexibility by providing a solid foundation for movement. When the core muscles are strong and stable, they allow for better movement patterns and alignment, reducing the strain on other muscles and joints.[8] This results in an increased range of motion and flexibility, as the body can move more freely without compensatory tension in the muscles.

Breathing exercises are recognized for their positive impact on flexibility and posture in healthy adults.[12] Additionally, core stabilizing exercises effectively strengthen muscles, improve balance, and increase overall body flexibility.[13,14] The PBT is designed based on the understanding that postural muscles serve postural control and breathing.[15] It simultaneously stimulates postural muscle contraction, Golgi tendon reflex inhibition, and breathing.

Stretching exercises have long been recognized as a fundamental method for improving flexibility, reducing muscle stiffness, and enhancing overall range of motion.[16] In this study, the Postural Stretching Technique (PST) is specifically designed to focus on the key postural muscles including the abdominal muscles, back muscles, pectoral muscles, trunk and hip muscles.

Previous studies have demonstrated positive outcomes of various exercise techniques on flexibility, including breathing exercises, Pilates techniques, and active stretching exercises.[16,17,18] However, there remains a significant gap regarding the combined effects of postural muscle strengthening and breathing exercises on body flexibility. Although most research has focused on these elements in isolation, the synergistic impact of these integrating has yet to be thoroughly investigated. It is essential to approach might enhance flexibility more effectively than any one technique alone. This study aimed to address this gap by comparing the effects of PBT and PST on flexibility. Due to the comprehensive approach of PBT, it was hypothesized that PBT could lead to a more significant improvement in body flexibility compared to PST in individuals with poor flexibility.

Materials and methods

Participants

The study was designed as a single-blinded, randomized controlled trial conducted at the Faculty of Associated Medical Sciences at Khon Kaen University, Thailand. The study protocol was registered in the RCT registry (TCTR20240902002). Participant recruitment focused on students who are studying in Khon Kaen University. Inclusion criteria included both genders, aged 18 to 24 years, with unilateral or bilateral hamstring tightness (PKE angle more than 20 degrees),[19,20] a BMI of 18.5-24.9 kg/m², and a sedentary lifestyle. Exclusion criteria were regular stretching exercises, muscle relaxant usage, fractures of the spine and/or lower extremities, hamstring muscle tendinitis or strain, hypermobility, severe orthopedic or neurological conditions, abdominal surgery within one year, seizures, respiratory problems, and uncontrolled hypotension or hypertension. The sample size was determined using the mean and standard deviation from the flexibility results from a previous study involving the Sit and Reach Test,[21] to calculated in a formula of n/group = $\frac{2\sigma^2(Z\alpha+Z\beta)^2(1-p^2)}{(\mu1-\mu2)^2}$,[22] 10% drop-out, therefore in 28 participants per group for a total of 56 participants.

The study was approved by the Khon Kaen University Human Ethics Committee (HE 662057). Participants were recruited through public posters and online information. A physical therapist assessed participants through the recruitment criteria, and written informed consent was obtained. Participants meeting the inclusion criteria were randomly assigned to the experimental (PBT) or comparison group (PST) by another physical therapist using the stratified block randomization with block size of 4 and 6. Gender (male and female), and degree of hamstring tightness ranges (group 1: male, 20-35 degrees, group 2: male, 36-50 degrees, group 3: female, 20-35 degrees, and group 4: female, 36-50 degrees) were used as the stratifying variables.[19] Each stratifying used block randomization with block sizes of 4 and 6 to achieve an approximate balance of important characteristics and equal participants in both groups. The study was single-blind, meaning that the participants were blinded to the group assignments. Participants performed exercises twice a week for 40 minutes per session for four weeks. The decision to conduct the training for four weeks was supported by literature suggesting that this duration is sufficient to observe measurable changes in flexibility.[21] The flow of the study is shown in Figure 1.

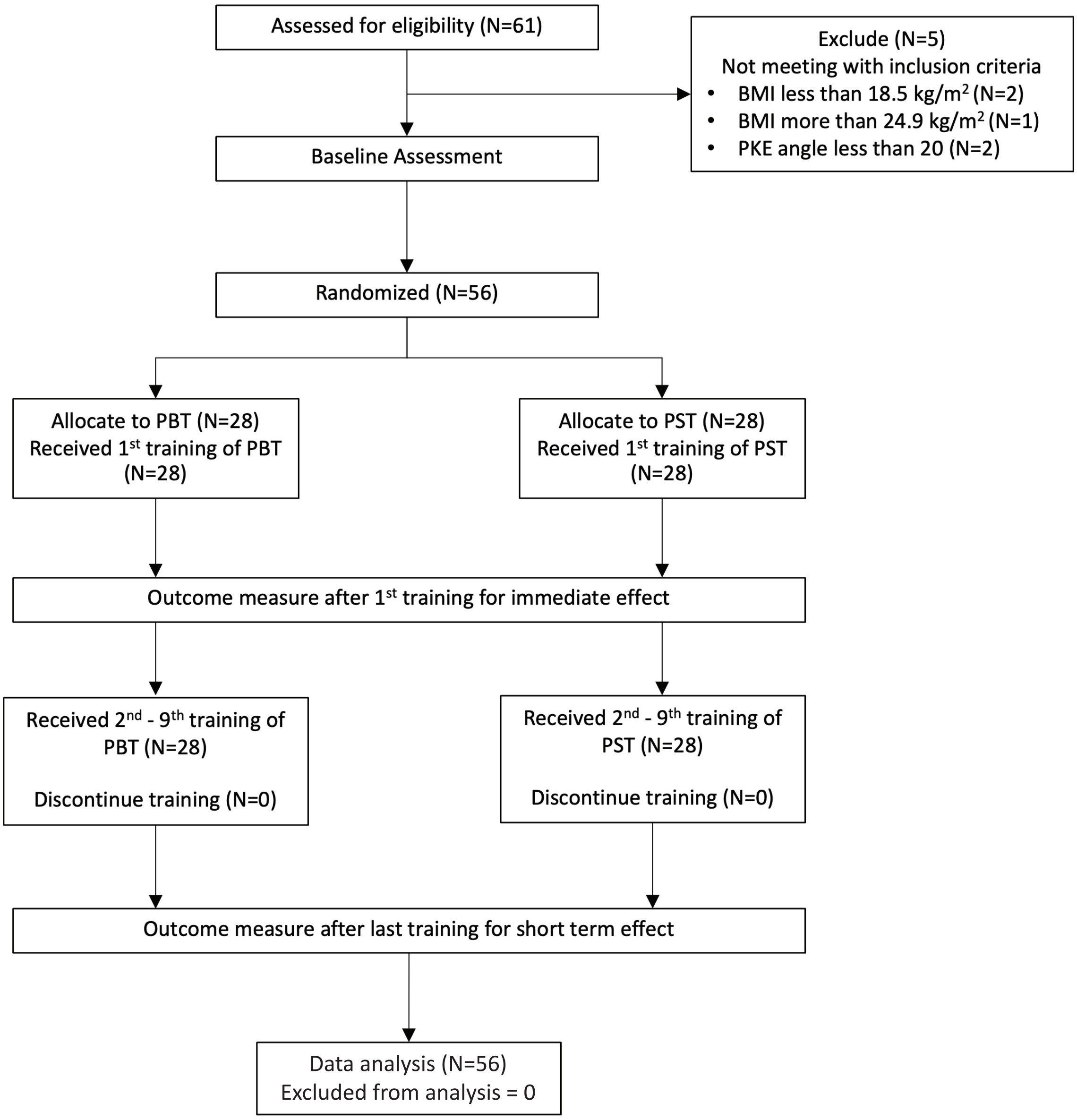


Figure 1. *Flow of the study.*

Intervention

Postural breath technique (PBT)

The experimental group practiced PBT consisting of 7 exercises. All the exercises involved inhaling for 7 seconds and exhaling for 14 seconds, which had to be repeated six times per set, for two sets, with a rest of 30 seconds in between exercises (Figure 2).[15] The design of the exercise intensity in this study was related to the previous study.[18] Detailed exercise procedures are described in supplementary sheet.

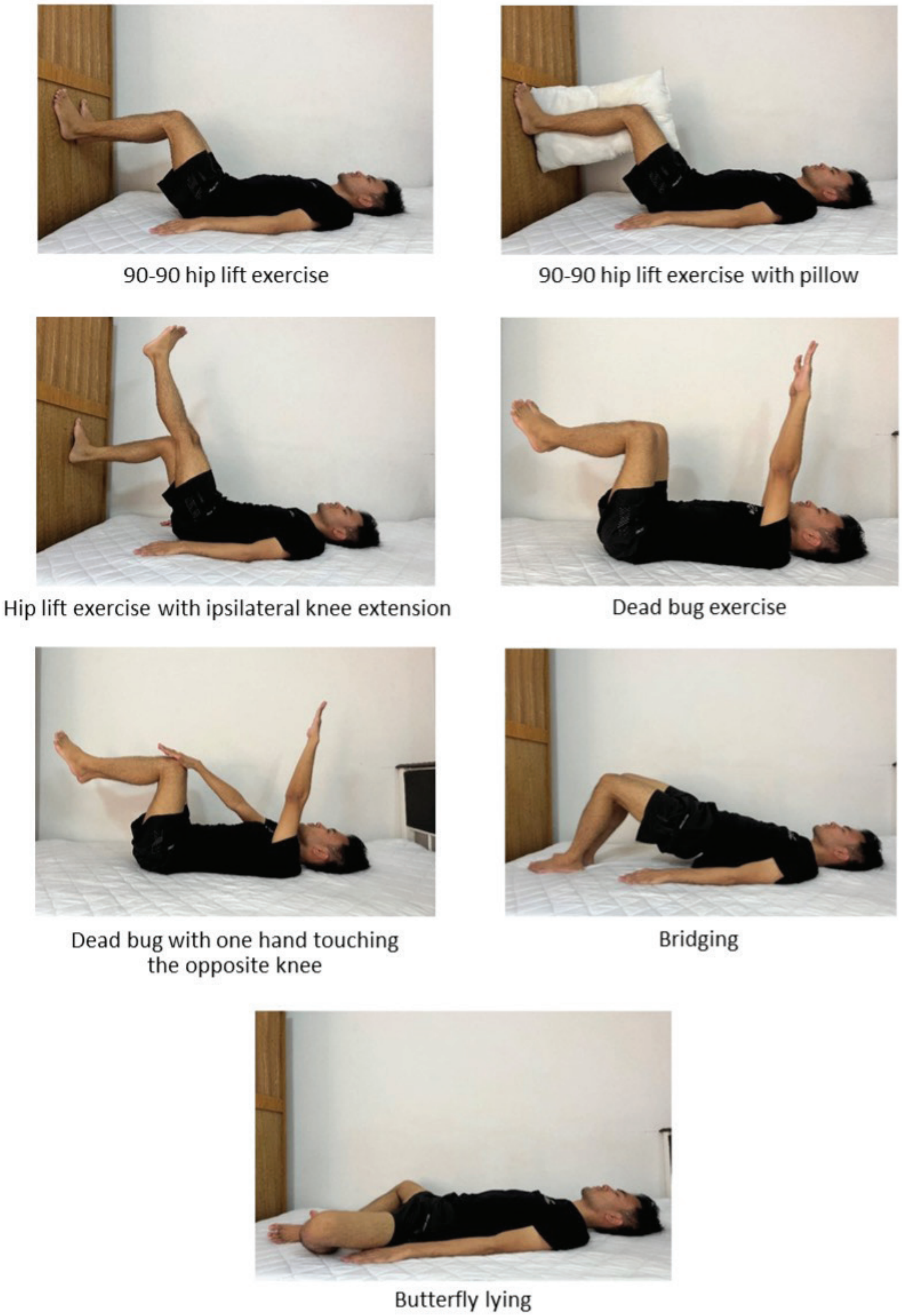


Figure 2. *Exercises positions of PBT.*

Postural stretching technique (PST)

The comparison group practiced PST consisting of 7 exercises. Each stretching exercise was performed holding for 30 seconds, repeated three times for each side, with a 30-second rest between exercises (Figure 3). The design of the exercise intensity was related to the previous study.[18] Detailed exercise procedures are described in the supplementary sheet.

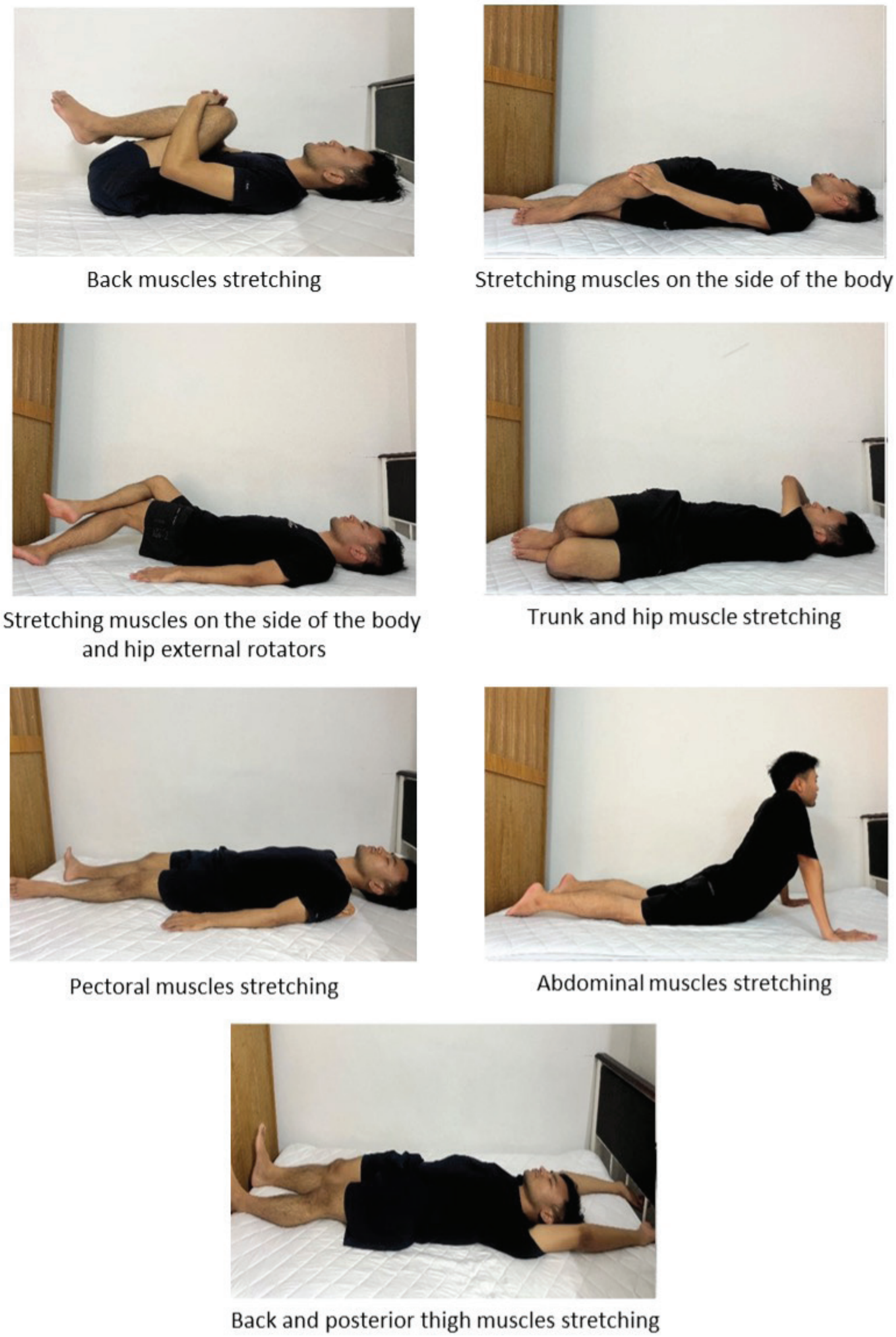


Figure 3. *Exercises positions of PST.*

Outcome parameters

In the primary outcome, the Sit and Reach Test (SRT) is a general flexibility test that relates to several body parts. To conduct the SRT, the participant sits on the floor with legs straight and feet pressed against the measuring box. The individual was then instructed to reach forward over the box, holding that position for two seconds. This test was repeated twice, and the maximum reach in centimeters was recorded as the flexibility value. Reliability of data obtained with this test (Figure 4) was reported to be high (ICC=0.92-0.99). [23]

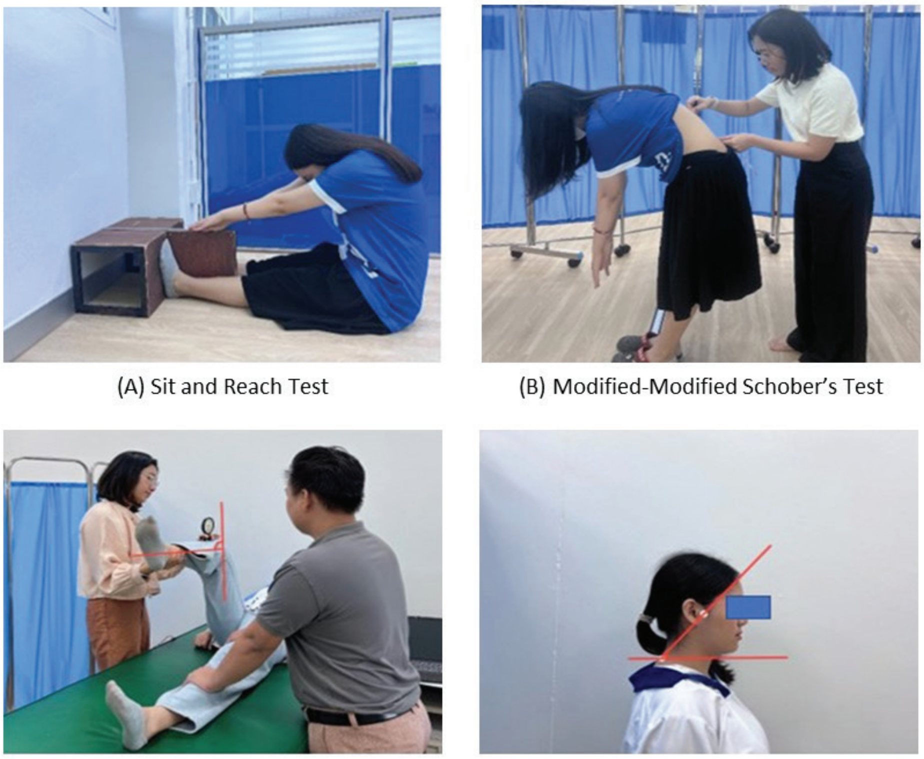
Modified-Modified Schober's test provides information about the range of motion of flexion of the lumbar spine and deep back muscles flexibility. For this procedure, the participants stood with their backs facing the examiner. The examiner palpated the lower edge of the backbone (PSIS) using their thumbs and marked this point with a horizontal line. Another line was drawn 15 centimeters above the midpoint of the first line. The difference between measurements in standing and bending forward was recorded as lumbar flexion. This measurement was repeated three times, and an average value was calculated. The reliability of data obtained with this test was reported to be high (ICC=0.91-0.95) as shown in Figure 4. [24]

The passive knee extension angle test is to determine hamstring flexibility. It is the gold standard for represent hamstrings flexibility. In this procedure, the participant lay comfortably on their back while the assessor bent one hip to 90 degrees, placing the inclinometer on the shin while the opposite leg remained straight on the table. The assessor then slowly extended the bent knee until a tolerable stretch was felt in the posterior thigh, recording the angle. This process was repeated three times, and the average score was calculated. Reliability of data obtained with this test (Figure 4) was reported to be high (ICC=0.92-0.93). [25]

The Craniovertebral Angle Test for forward head posture examination involved the participant sitting in a relaxed position without back support. The examiner marked the bony prominence at C7 and the tragus of the ear. A horizontal line was drawn through C7, and the angle between the line from C7 to the tragus and the horizontal line was measured using a goniometer. Reliability of data obtained with this test (Figure 4) was reported to be high (ICC=0.91-0.99).[26]

Statistical analysis

Data were analyzed using SPSS Version 28.0. The demographic data were described with descriptive statistics such as mean and standard deviation after checking for normal distribution by the Shapiro-Wilk test. The independent t-test was used to compared baseline characteristics variables between groups. Mixed Model Analysis of Variance was used in this study since the dependent variables were assessed at three-time points: baseline, after 1st week, and after 4th week of training. Post-hoc analysis (Tukey's Honest Significant Difference; HSD) was conducted to evaluate specific differences between means in both groups. The statistical significance was set at an alpha level of <0.05.



(A) Sit and Reach Test
(B) Modified-Modified Schober's Test
(C) Passive Knee Extension Test
(D) Craniovertebral Angle Test

Figure 4. *Tests for outcome measurements.*

Results

Demographic data and baseline characteristics

Of 61 interested volunteers, 56 participants met the inclusion criteria and were randomized into two groups. Both groups had a balanced gender distribution. No dropouts occurred, and no adverse events were reported. Baseline characteristics were comparable, including age, university affiliation, passive knee extension (PKE), and Body Mass Index (BMI). The demographic data and baseline characteristics were found to be equally balanced between groups (p>0.05) as shown in Table 1.

Sit and Reach Test

A mixed-model ANOVA test revealed a non-significant interaction between groups and time [F(1.364, 54.636) = 0.565, p=0.506, partial ɳp2 =0.010]. There was a difference in the SR at different times for both groups. Within-group comparisons showed statistical significance across various time points in both PBT and PST groups (Table 2). However, no significant differences were found between the groups at any time (p>0.05) (Table 3).

Modified-Modified Schober's Test (MMST)

In the mixed-model ANOVA test, the MMST outcome accepted an assumption of sphericity (Mauchly's test was nonsignificant p>0.05). There was significant interaction between groups and time [F(2,54)=23.575, p<0.001, partial ɳ2=0.304]. There was a difference in the MMST at different times for both groups. Within-group analyses revealed significant improvement in MMST for the PBT group (p<0.001), while the PST group exhibited substantial improvement from baseline to the short-term effect (p<0.001) (Table 2). Between-group comparison indicated no significant difference in MMST between the two groups (Table 3).

Passive Knee Extension Test (PKE)

The PKE outcome in the mixed-model ANOVA showed a non-significant interaction between groups and time [F(1.725, 54.275)=0.438, p=0.617, partial ɳp2=0.008] for left-sided PKE values and [F(2,54)=0.375, p=0.688, partial ɳp2=0.007] for right-sided PKE values, respectively. There was a difference in the PKE at different times for both groups. Within-group comparisons showed improvements in PKE values across various time points (p<0.001) (Table 2). However, there were no significant differences between the groups at any time (p>0.05) (Table 3).

Craniovertebral Angle Test (CVA)

In the mixed-model ANOVA test, the CVA outcome accepted an assumption of sphericity (Mauchly's test was non-significant p>0.05), with a non-significant interaction effect between groups and time [F(2,54)=0.527, p=0.592, partial ɳp2=0.010]. Within-group comparisons resulted in a significant change in CVA for the PBT group, while the PST group showed a significant difference between baseline and immediate effect (p=0.017) (Table 2). Between-group comparisons indicated no significant differences at any point (Table 3).

Table 1. Demographic data and participant characteristics.

Variable	PBT group (N=28)	PST group (N=28)
Age (years)	19.43±1.03 (18-22)	19.71±1.18 (18-23)
Gender (N, %)		
Male	15 (53.57%)	14 (50.00%)
Female	13 (46.43%)	14 (50.00%)
Weight (kg)	58.33±8.00 (43-74.5)	58.57±9.29 (43-76)
Height (cm)	165.36±9.50 (150-180)	165.61±8.99 (152-180)
Body mass index (kg/m^2)	21.47±1.88 (18.6-24.5)	21.21±2.20 (18.5-24.8)
PKE (Lt) (degree)	31.02±8.81 (20.4-51.4)	31.36±10.18 (21.5-51.4)
PKE (Rt) (degree)	31.03±8.64 (21.0-49.0)	29.93±8.97 (20.2-49.0)

***Note**: PKE(Lt): passive knee extension(left), PKE(Rt): passive knee extension(right). Data presents with mean and min-max and no significance of baseline values between groups.*

Table 2. Comparison of outcomes within each group among baseline, immediate, and the fourth week after training in the PBT and PST group.

Outcomes	PBT					PST				
	Baseline	Immediate effect	Effect size (Cohen's d)	Short term effect	Effect size (Cohen's d)	Baseline	Immediate effect	Effect size (Cohen's d)	Short term effect	Effect size (Cohen's d)
SRT	6.44 ± 6.59	7.61 ± 6.09*	3.95	12.79 ± 5.41**	5.55	5.61 ± 5.35	7.13 ± 5.51*	3.87	11.39 ±5.00**	5.28
MMST	6.33± 0.73	7.34±1.30*	9.59	9.33±0.83**	10.99	6.18±1.10	6.66±1.58	7.84	7.03±1.09**	8.93
Lt. PKE	31.39 ± 8.75	25.11 ± 3.34*	16.25	13.36 ± 6.90**	11.31	31.36 ± 10.18	27.19 ±11.87*	12.47	15.85 ± 7.37**	11.27
Rt. PKE	31.03 ± 8.64	24.31 ± 10.08*	12.79	13.30 ± 6.71**	11.31	29.92± 8.96	25.08 ±12.43*	11.89	16.14 ± 7.67**	11.29
CVA	47.79± 6.03	49.54±5.37*	28.83	52.02±5.19**	29.80	49.04±6.19	50.36±6.08	28.38	52.22±5.88**	29.15

***Note**: SRT: sit and reach test, MMST: modified-modified Schober's test, Rt.PKE: the passive knee extension angle test (right side), Lt.PKE: the passive knee extension angle test (left side), CVA: the craniovertebral angle test. *Statistically significant differences between immediate and baseline ($p<0.05$). **statistically significant differences between fourth week measurement and baseline ($p<0.05$).*

Table 3. Comparison of outcomes between PBT and PST group among baseline, immediate, and the fourth week after training.

Outcome measurements	Immediate effects			Short term effects		
	PBT	PST	Mean difference (95% CI)	PBT	PST	Mean difference (95% CI)
SRT	7.61±6.09	7.13±5.51	0.49 (-2.63 to 3.60)	12.79±5.41	11.39±5.00	1.40 (-1.39 to 4.19)
MMST	7.34±1.30	6.66±1.58	0.68 (-0.16 to 1.52)	9.33±0.83	7.03±1.09	2.30 (-1.78 to 2.82)
Lt. PKE	25.11±3.34	27.19±11.87	-2.08 (-7.87 to 3.71)	13.36±6.90	15.85±7.37	-2.49 (-6.36 to 1.37)
Rt. PKE	24.31±10.08	25.08±12.43	-0.78 (-6.84 to 5.29)	13.30±6.71	16.14±7.67	-2.84 (-6.70 to 1.02)
CVA	49.54±5.37	50.36±6.08	-0.821 (-3.89 to 2.25)	52.02±5.19	52.22±5.88	-0.20 (-3.17 to 2.77)

***Note**: SRT: sit and reach test, MMST: modified-modified Schober's test, Rt.PKE: the passive knee extension angle test (right side), Lt.PKE: the passive knee extension angle test (left side), CVA: the craniovertebral angle test, no significance between groups.*

Discussion

The aim of the study was to compare the effects of PBT and PST on body flexibility in individuals with poor flexibility. Within each group, both PBT and PST significantly increased SRT scores, decreased PKE angle on both sides and improved MMST and CVA. The mixed-model ANOVA revealed significant differences within groups at each assessment point. PBT resulted in immediate and after four weeks improvements in SRT, MMST, PKE, and CVA, while PST showed increased of all outcomes after four weeks. However, there was no significant difference between the PBT and PST groups.

Effect on General Flexibility

PBT significantly increased SRT at all time points, showing improved trunk flexibility. These findings align with previous studies using a different technique but a similar style of core movement with breathing control.[12,16] Several mechanisms may have contributed to the increase in SRT scores. PBT consists of active movements of core muscles with breathing. This keeps the main muscles, such as the rectus abdominis, obliques, and deep core stabilizers like the transversus abdominis, in an eccentric contraction and stretching rhythm during exhalation. Eccentric contraction occurs when the muscle lengthens under tension, which is beneficial for increasing flexibility as it promotes muscle elongation and enhances the neurophysiological properties of contractile tissues.

When PBT is applied, muscles activate the golgi tendon organ (GTO), a proprioceptive sensory receptor located in the tendons that can detect changes in muscle tension. The activation of the GTO inhibits alpha motor neuron activity, leading to a decrease in muscle tension, which allows the sarcomeres (the basic unit of a muscle's contraction) to lengthen.[27] In contrast, the PST also contributes to increased flexibility, its primary mechanism might be related to the viscoelastic properties of the muscles and tendons. Shrier and Gossal and Kubo *et al*. have reported that stretching exercises increase the range of motion by either decreasing viscoelasticity or increasing stretch tolerance.[28,29]

Effect on hamstring muscles

PBT significantly decreased the degree of passive knee extension angle, indicating improved hamstring flexibility. This technique utilizes proprioceptive neuromuscular inhibition to release contraction knots of the sarcomere and enhance blood circulation and oxygen supply. The muscle movements combined with slow, deep breathing produce an excellent oxygen supply.[30,31] Increasing blood flow removes pain and proinflammatory mediators,[30] which can lead to increased flexibility.

In addition to PBT, the PST also improved hamstring flexibility. The stress-strain curve explains this effect. When force is gently applied perpendicular to the tissue, the wavy collagen fibers straighten. With increased tension, a recoverable deformation occurs within the elastic range, resulting in new length and enhanced flexibility and range of motion.[32]

Effect on back extensor muscles

Both groups showed statistically significant improvements in short-term effects, with the PBT group being significantly superior, consistent with previous studies.[33] In those studies, researchers found that the increasing flexibility of university students could be measured using the modified Schober test after applying pilates techniques. PBT likely activates core muscles such as the iliocostalis, erector spinae, and multifidi, improving these muscles' flexibility.[34] The eccentric contractions of these muscles during PBT contribute to the gradual lengthening of muscle fibers, which enhances flexibility.

Effect on neck extensor muscles

The PBT significantly increased CVA with both immediate and short-term effects. In contrast, Byung-Sun Kong *et al*. found no significant interaction effects on CVA in straight-necked women because of breathing exercises.[35] The significant increased CVA of the present study may be due to the role of postural muscles in PBT.

The PST group showed an increase in short-term effects, consistent with a previous study that reported static stretching of hamstring muscles increases cervical range of motion.[36] This is likely due to the concept of myofascial meridians, where loosening the musculofascial component in one area can increase the flexibility of the same element in a distant location on the same meridian.[37] Additionally, reducing neural tension may also play a role, as stretching can alleviate nerve compression, thereby improving flexibility in connected regions.

Both PBT and PST exercises can explain the same effect of force on the Golgi tendon organ. From neuroscience knowledge, when an agonist muscle is contracted long enough or stretched with an appropriate force, the Golgi tendon organ of the muscle sends an electrical signal through the 1b afferent fiber into the spinal cord. It stimulates inhibitory interneurons to inhibit the alpha motor neuron of the agonist muscle for relaxation, a mechanism called autogenic inhibition.[38] Based on biomechanics, the postural muscles have two important functions: postural control and breathing.[39] Therefore, the design of exercises in the PBT group includes breathing exercises.

Conclusion

A recent study investigated the effect of PBT and PST on body flexibility over four weeks. Results indicate that both PBT and PST similarly improve general body and hamstring flexibility, with immediate improvements observed in back and neck extensor muscles flexibility with PBT, while PST shows increased flexibility after four weeks. However, there is no significant difference between the two groups. Both PBT and PST are recommended in clinical practice for improving flexibility, with PBT offering immediate benefits and PST providing sustained gains. The choice between these techniques should be based on patient needs, clinical goals, and practitioner expertise. Limitations of the recent study include focusing on young, healthy individuals and a short duration, suggesting future studies with broader participant demographics and more extended training periods to explore long-term effects comprehensively. Moreover, we could not entirely control the participants' daily activities, which should be monitored for specific results in the future study.

Ethical approval

The study protocol was registered in the RCT registry (TCTR20240902002).

Conflict of interest

The authors declared no potential conflicts of interest to the research, authorship, and/or publication of this article.

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Supplementary

Exercise methods for participants in the experimental group.

Postural breath technique				
No.	**Exercise**	**Position**	**Training method**	**Number of trainings**
1	90-90 hip lift exercise	The participant lies supine comfortably.	The volunteer flexes hips and knees 90 degrees so that the soles of feet touch the wall with their buttocks lifted (lift tail bone 1-inch from the floor). Inhales for 7 seconds and then exhales for 14 seconds.	Repeat six times per one set, rest and relax for 30 seconds, performs two sets.
2	90-90 hip lift exercise with pillow	The participant lies supine comfortably.	The participant flexes hips and knees 90 degrees and pins the pillow so that the soles of feet touch the wall with their buttocks lifted (lift tail bone 1-inch from the floor). Inhales for 7 seconds and then exhales for 14 seconds. During exhalation, the participant compresses the pillow slowly.	Repeat six times per one set, rest and relax for 30 seconds, performs two sets.
3	90-90 hip lift exercise with ipsilateral knee extension	The participant lies supine comfortably.	The participant flexes hips and knees 90 degrees so that the soles of feet touch the wall with their buttocks lifted (lift tail bone 1-inch from the floor). Inhales for 7 seconds and then exhales for 14 seconds. During exhalation, the participant extends one side of the knee slowly. On the next exhalation, the volunteer extends the other knee alternatively.	Repeat six times per one set, rest and relax for 30 seconds, performs two sets.
4	Dead bug exercise	The participant lies supine comfortably	The participant flexes hips and knees 90 degrees with both arms raising. Inhales for 7 seconds and then exhales for 14 seconds.	Repeat six times per one set, rest and relax for 30 seconds, performs two sets.
5	Dead bug exercise with one hand touching the opposite knee	The participant lies supine comfortably.	The participant flexes hips and knees 90 degrees with both arms raising. Inhales for 7 seconds and then exhales for 14 seconds. During exhalation, the participant uses one hand to touch the opposite knee. On the next exhalation, the volunteer uses the other hand to touch the opposite knee alternatively.	Repeat six times per one set, rest and relax for 30 seconds, performs two sets.
6	Bridging	The participant lies supine comfortably.	The participant lies in a crook and raises their hips above the floor. Inhales for 7 seconds and then exhales for 14 seconds.	Repeat six times per one set, rest and relax for 30 seconds, performs two sets.
7	Butterfly lying	The participant lies supine comfortably.	The participant lies in a crook position. Inhales for 7 seconds and then exhales for 14 seconds. The participant folds their hips with inhalation and spreads their hips with exhalation.	Repeat six times per one set, rest and relax for 30 seconds, performs two sets

Exercise methods for participants in the control group

Postural muscle stretching exercises				
No.	**Exercise**	**Position**	**Training method**	**Number of trainings**
1	Back muscles stretching	The participant lies supine comfortably	The participant holds his or her knees to the anterior chest wall for 30 seconds and then returns to starting position. Rest and relax for 30 seconds, and performs the next session	3 times
2	Back and posterior thigh muscles stretching	The participant lies supine comfortably.	The participant dorsiflex the ankle and rise his or her arm over head for 30 seconds. Rest and relax for 30 seconds, and performs the next session.	3 times
3	Stretching the muscles on the sides of the body	The participant lies supine comfortably.	The participant lifts their right leg across the left leg. Using the left hand, hold the right knee for 30 seconds. Rest and relax for 30 seconds, and performs the next session	3 times on the right and 3 times on the left sides
4	Stretching the muscles on the sides of the body and hip external rotators	The participant lies supine comfortably.	The participant lifts the right leg cross and holds the left leg for 30 seconds. Rest and relax for 30 seconds and performs the next session.	3 times on the right and 3 times on the left sides
5	Trunk and hip muscles stretching	The participant lies supine comfortably.	The participant changes from supine lying to crook lying and bends shoulders forwardly with hands interlocking. Twist the upper and lower body in opposite directions during exhale and hold for 30 seconds. Inhale and return to starting position. Rest and relax for 30 seconds and performs the next session.	3 times on the right and 3 times on the left sides.
6	Pectoral muscles stretching	The participant lies supine comfortably.	Roll two towels in a circle and insert it under the scapulae for dropping shoulders downwardly. Holding 60 seconds and return to starting position. Rest and relax for 30 seconds and performs the next session.	3 times
7	Abdominal muscles stretching	The participant lies in a prone position	The participant pushes the body backward with the upper limbs and holds for 30 seconds. Return to starting position. Rest and relax for 30 seconds, and performs the next session	3 times