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A Comparative Study on the Effectiveness of Schroth based Exercise versus Theraband Exercise along with Modified Classical Yoga in Treating Postural Kyphosis among College Students

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Abstract

Background: To compare the effectiveness of Schroth-based exercise versus theraband exercise along with modified classical yoga in treating postural kyphosis among college students.

Materials and Methods: The research design was a comparative study. Thirty individuals were randomly assigned to two groups. Group A received Schroth-based exercise, whereas Group B received theraband exercise and modified classical yoga. Each group was evaluated using outcome measures such as the thoracic kyphosis angle and kyphotic appearance.

Results: Data analysis was done by using paired and unpaired 't' test for within group and between group. Statistical analysis between groups showed significant improvement in group A ($P<0.0001$). The result of the study shows that in group A, the thoracic kyphotic angle and kyphotic appearance have reduced than group B among college students.

Conclusion: A comparative research was undertaken to assess the effect of Schroth-based exercise vs theraband exercise combined with modified classical yoga in treating postural kyphosis among college students. Schroth-based exercise combined with modified classical yoga is beneficial for lowering the kyphotic angle and improving kyphotic appearence in college students with postural kyphosis.

Keywords: Flexicurve kyphosis angle (FKA), Kyphosis specific spinal appearance questionnaire (K-SAQ)

1. INTRODUCTION

Postural kyphosis[(1,2)] is a common spinal curvature problem that occurs when thespine experiences excessive external stress while in an upright stance[(3)]. Kyphosis is a sagittal deviation of the spine characterized by excessive anterior spine concavity [(4)].In people between the ages of 20 to 50 the occurrence of the thoracic kyphosis is 38%, whereas in children under the age of 11, it is 15%[(5)]. Postural kyphosis does not result in structural changes and the vertebrae remain normal [(6)].Long periods of sitting, poor posture while sitting and standing, and carrying a heavy backpack can contribute to sagittal malalignment[(7)]. A slouched posture adopted by an individual increases forward curvature,

lengthens the extensors of the back and posterior spinal ligaments, shortens the anterior pectoral muscles, and decreases muscle strength over time[8]. Symptoms of postural kyphosis include rounded shoulders, fatigue, upper back stiffness, and a visible hump in the back. This anterior thoracic posture is associated with significantly higher shear and compressive stresses on the intervertebral disk[9] and progresses to neurological symptoms.

Thoracic kyphosis is a curvature between the T1 and T12 vertebral body[10]. Normalthoracic kyphosis ranges from 20º to 40º when assessed radio-graphically and nonradiographically. Excessive thoracic kyphosis is defined as a kyphosis > 50º [11].Spinaldeformities have been linked to a lower quality of life and low self-esteem.

Katharina Schroth developed Schroth Therapy, a three-dimensional exercise therapy program, in Germany during the 1920s [12.]. It is built on sensorimotor and kinesthetic principles. The programme also includes proprioceptive and exteroceptive stimulation, as well as a specific breathing pattern. Exercises include exerting external forces on the vertebral column, correcting the three blocks in the sagittal plane, and applying elongation forces to the vertebral column. Exercises are designed to improve vital capacity.

Yoga is a non-invasive, easily accessible intervention with minimal or no sideeffects. It not only helps to achieve physical, psychological, and spiritual well-being, but also has the ability to correct posture. Yoga is well-known for its numerous health benefits, including relieving muscle tension, stretching joints, and improving range of motion. One important fitness component that contributes to posture is flexibility. The yoga program is made up of four series of poses adapted from classical forms of yoga. Postural improvement occurs as a result of increased strength, flexibility, and postural awareness. Improved well-being may also result from the contemplative mood that yoga's mind-body approach encourages [13].

Recently, Thera-Band has been used not only to provide resistance for exercise,but also to deliver isometric contractions for muscle pre-activation or reciprocal inhibition during therapeutic exercise along with breath control[14].

These patients often have concerns about their appearance, and a kyphosis-specificspinal appearance questionnaire has been developed to better identify their needs and priorities. Patient-reported outcomes have shown to improve communication between patients and providers, as well as patient satisfaction [15].

The treatment approaches like Schroth exercises, theraband exercise, and yoga areeffective in treating postural kyphosis. The study is to compare the effect of Schroth-based exercise versus theraband exercise along with modified classical yoga in reducing kyphotic angle and improving appearance among college students with postural kyphosis.

2. Material and Methods

This is a comparative study that includes 30 subjects with postural kyphosis and is conducted at Sri Venkateshwaraa Medical College and Hospital, Puducherry. Subjects were allocated into two groups (Group A- 15 & Group B- 15) based on inclusion criteria. Exclusion criteria. In both groups, the subjects were trained over 6 days per week, 3 sets of 10 repetitions for 6 weeks. The Flexicurve kyphosis angle (FKA), and kyphosis-specific spinal appearance questionnaire (K-SAQ) were measured before and after the intervention for all participants. The Group A subjects received Schroth-Based Exercise with modified classical yoga and Group B subjects received Theraband Exercise with Modified Classical Yoga.

From April to October of 2023, students at Sri Venkateshwaraa College of Paramedical Science in Ariyur, Puducherry, participated in this prospective comparative study. This study included 30 participants who were at least 18 years old.

Study Design **:** A comparative study
Study Location : Sri Venkateshwaraa College of Paramedical Science
Study Duration **:** 6 months.
Sample Size **:** 30 samples. (Group A 15) (Group B 15)

Inclusion criteria:

1. Subjects who are willing to sign the informed consent and participate.
2. Subjects with age 18 to 23 years.
3. Subjects Presented with postural kyphosis.
4. Subjects with a minimum score of 5 in the occipital wall test

Exclusion criteria:

1. Congenital hyperkyphosis
2. Traumatic hyperkyphosis
3. History of fracture
4. Irregular heart functions
5. Recent head injury
6. Recent surgery
7. Past history of falls or sprain

3. Procedure methodology

Following written informed consent, the students were divided into two groups, A and B, using a randomized sampling method. Pre-assessment outcomes such as FKA and K-SAQ values were obtained individually from each person in both groups. Later, exercises designed for each group were administered to the students for six months, and post-outcome values were recorded.

The exercises for students with postural kyphosis were as follows:

Group **A-** Schroth Therapy with Modified Classical Yoga
Group **B-** Theraband Exercise with Modified Classical Yoga.

GROUP-A: SCHROTH BASED EXERCISE

FIG: 1 PENDULLUM

- Make the person to hang on a vertical bar
- Draw one shoulder blade down “slide ear up arm”
- Then return back to center
- Perform on either side left and right

FIG: 2 SEMI HANGING

- Stand opposite to the vertical bar and grab it on eye level with feet under bottom of the bar
- Now hang on the bar and perform normal inspiration and expiration and feel the stretch for 20 seconds

FIG:3 COORECTION IN SITTING FORE ARM AGAINST THE KNEE

- Sit up straight on a chair with your feet flat on the ground
- Position the knees at 90 degree flexion or slightly acute
- Place the forearm on the thighs, with your hands facing downward
- Gently push your forearm against the knees to create tension
- Keep your back straight and your shoulder relaxed

FIG: 4 CORRECTION IN SUPINE-ELBOW AGAINST THE FLOOR

- Ask the person to position in crook lying
- Bend your elbow at 90 degree flexion and shoulder abducted at 90 degree so the arm is flat on the ground, forearm is placed vertically above
- Place two pillows under the elbows
- Now press the pillows with the elbow

FIG: 5 CORRECTION IN STANDING-AGAINST ELASTIC BAND

- Stand with your feet shoulder width apart. Hold the elastic band to a sturdy point
- Hold the ends of elastic band with both hands while shoulder abducted and elbow flexed at 90 degree

GROUP-B: THERABAND EXERCISE

FIG: 6 NECK RETRACTION EXERCISE

- Stand comfortably with good posture
- Wrap the theraband around the head and hold the ends with hand at eye level
- Slowly retract the neck against the theraband without tilting it up or down
- Hold this position and then release slowly returning to starting position

FIG: 7 SCAPULAR RETRATION EXERCISE

- Stand with feet at shoulder width apart and ensure your spine is straight
- Hold the theraband in both hands, with your arms extended in front of you at shoulder height with theraband with slight tension
- Grip the theraband with your palm facing downward, slightly wider than shoulder width apart
- Slowly pull the band outward and backward
- Hold the retracted position and feelthe muscle engaged then release and return to starting position

FIG: 8 RESISTIVE SHOULDER BLADE SQUEEZE

- Stand in front of a sturdy point like window or door knob
- Wrap a resistance band around the object so that one end of band is in each hand
- Now pull the hands towards the shoulder by squeezing the scapula. Hold in this position and return it to the starting position

GROUP-A&B: MODIFIED CLASSICAL YOGA

FIG: 9 RECUMBDENT UPPER EXTRIMITY STRETCH

- Lie on crook lying position with feet on the floor.flex the shoulder at 90 degree with palm facing upward

- Place a thick pillow under the upper back on inhalation press back into your heels to roll the pelvis forward
- Rest your head with either the back of your head
- Stay here for 15 to 30 seconds

FIG: 10 HANDS AND KNEES

- Position in quadripod with wrists under the shoulder and knees under the hip
- Lift your leg to hip level while maintaining a straight leg by extending and flexing your right foot toward the back of your mat.
- Maintaining a straight arm, raise your left arm to shoulder height. Take five to ten breaths before lowering the raised hand and knee, then repeat the pose on the opposite side. Point your thumb toward the ceiling or turn your palm toward the floor.

FIG: 11 PRONE BACKBEND

- Start by lying face down on your mat. Exhale and lift your head, chest and leg off the floor, extend your arms and legs as far as you can by keeping your lower abdomen and pelvis on the floor.
- Feel the stretch of the spine and your legs in a concave shape. Hold this position for 20 – 30 seconds release.

FIG: 12 STANDING POSE

- Bend your knees and with an inhale step right foot back towards the back edge of the mat with the ball of the foot on the floor
- Now raise both the upper limb with palm facing medially so that it is parallel to the lower limb facing backward
- Exhale and step your left foot back. Repeat the above instruction

4. Statistical Analysis

The obtained outcome values were calculated manually. This study aimed to compare the effectiveness of Schroth therapy with Theraband exercise and modified classical yoga in the treatment of postural kyphosis in university students. Significant differences in comparison were found between the two groups. Differences between pre-test and post-test interventions within the two groups were analyzed using paired "t" tests for outcome measures. Statistical significance was set at p value.

5. Result

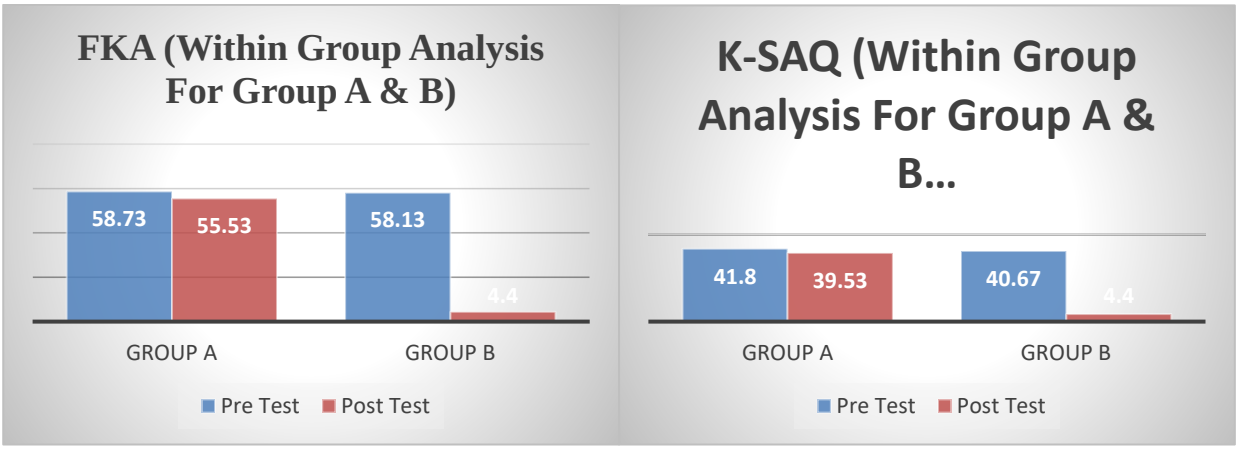
The data obtained were analyzed using paired and unpaired t-tests and summarized in a table. In the between-group analysis of Group A, the mean and standard deviation of FKA values before and after the test were 58.73 ± 3.13 and 55.53 ± 2.88, respectively, with a t-value of 8.70. The mean and SD of K-SAQ pre and post-test values are 41.80±3.91 and 39.53±3.83 and 't' value is 7.17. The statistical analysis is done with paired 't' test with Group A analysis shows extreme significance of<0.0001.

In the within-group analysis for group B, the mean and standard deviation of pre-test and post-test FKA values were 58.13±2.26 and 55.87±2.61 with a "t" value of 7.54. The mean and standard deviation of pre-test and post-test K-SAQ values were 40.67±3.35 and 39.27±3.73 with a "t" value of 8.57. Statistical analysis is performed in the "T" test of the pair using Group B analysis.

TABLE NO 1: WITHIN GROUP ANALYSIS FOR GROUP A AND B – Paired 't' TEST

MEASURES	GROUP	TEST	MEAN	SD	t-value	p-value
FKA	Group-A	Pre test	58.73	3.13	8.70	<0.0001
		Post test	55.53	2.88		
	Group-B	Pre test	58.13	2.26	7.54	<0.0001
		Post test	55.87	2.61		
K-SAQ	Group-A	Pre test	41.80	3.91	7.17	<0.0001
		Post test	39.53	3.83		

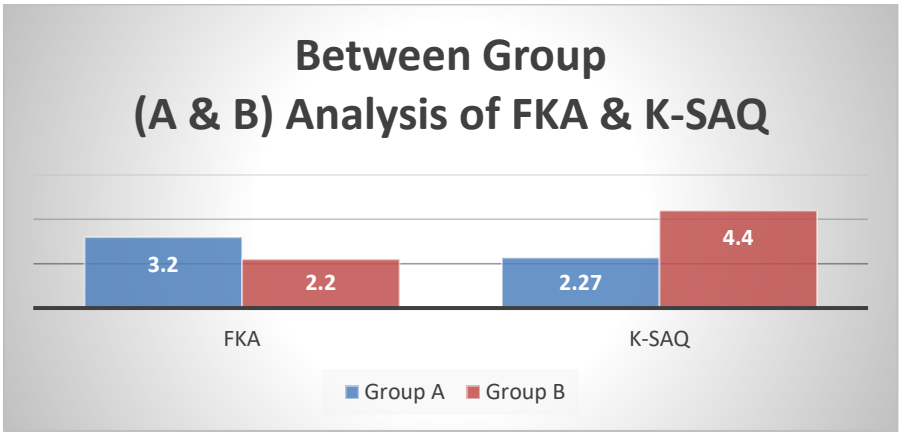
	Group-B	Pre test	40.67	3.35	8.57	<0.0001
		Post test	39.27	3.73		



Statistical analysis between groups A and B. The mean and SD of FKA in group A is 3.20 ± 1.42 and in group B is 2.20 ± 1.01, with a t-value of 2.21. The mean and standard deviation of the K-SAQ was 2.27 ± 1.22 in group A and 1.40 ± 0.63 in group B, with a "t" value of 2.43.

TABLE NO 2: BETWEEN GROUP ANALYSIS FOR GROUP A AND B – Unpaired 't' TEST

MEASURES	Group-A		Group-B		t-value	p-value
	MEAN	SD	MEAN	SD		
FKA	3.20	1.42	2.20	1.01	2.21	0.03
K-SAQ	2.27	1.22	1.40	0.63	2.43	0.02



6. Discussion

The aim of this study is to compare the effectiveness of exercises based on the Schroth method with Theraband exercises and classical yoga corrective postural hyperkyphosis in students.Risk factors for postural hyperkyphosis in children and adolescents are poor posture while sitting, long hours per day using electronic devices and habitual poor posture, which is easier to treat at this stage. 30 subjects who fulfilled the inclusion and exclusion criteria were taken with a age group of 18-23 in this study.The Pre-test was taken for (group A - 15 and group B - 15) using flexicurve kyphosis angle and kyphosis specific spinal appearance questionnaire. After 6 weeks of training, post-test was taken for both the groups. Statistical analysis was done using the paired 't' test.

TomerBezalel, Eli Carmeli.,(2018) Conducted research on the topic The Effect of Schroth Therapy on Thoracic Kyphotic Curve and Quality of Life in Scheuermann's Patients: A Randomized Controlled Trial. First, the elongation and strengthening force that targets the muscles supporting the spine is crucial for postural correction. The second, three-dimensional approach of schroth aims to de-rotate and elongate the spine, targeting spinal curvature from various angles. The breathing technique facilitates rib mobilization, expansion of the chest wall, elongation of the spine, and improvement of posture. Patients treated with the Schroth method were instructed to maintain the corrected posture while performing their daily activities; this increased treatment time. Finally, although all the patients of the RAR therapy group carried out the same five exercises; Each exercise has been adapted individually for each element in accordance with its installation or installation. Thus, the SWRO therapy group has shown significantly more important improvement than a classic group of gravity exercises [(16)].

T. Bezalel, L. Kalichman.,(2014) Case reports of improvement in clinical and radiological findings of Schuermann's disease after treatment with Schroth therapy suggest that Schroth therapy may be effective in preventing deterioration and reducing the curvature of the thoracic angle in patients with Schuermann's disease [(17)].

Amany E. Abd-Eltawab.,(2020)A study was conducted to determine the effectiveness of Theraband compared to standard active exercise in improving postural kyphosis. Kyphosis Index (IK) was calculated before and after treatment. The back muscles have extensive attachments to the spine and function as back extensors. Stronger back muscles are better able to resist forward gravity on the thoracic spine. Theraband exercises aimed at strengthening the extensor muscles have been shown to reduce kyphosis. Additionally, it can increase awareness of proper posture, encourage the development of muscle memory (how to contract effectively) through repetitive training, and reinforce the proper muscle activation pattern, which leads to improvements in overall movement pattern and posture over time. The results concluded that theraband was more effective than general active exercise[(18)].

A-Reum Shin, BSc; Ji-Hyun Lee, (2018) The effects of Thera-Band administration on scapular winging, kyphosis, and muscle activation during knee push-ups plus were investigated in a cross-sectional study. Because Thera-Band reduces RA and SA muscle activity as well as TKA and SW during KPP in individuals with SW, they found that applying it to the occiput and thorax may be beneficial. Both isometric contraction for muscle preactivation or reciprocal inhibition during therapeutic activities and resistance during exercise have been produced using Thera-Band [(19)].

Bharati G Dhokrat (2014)conducted an experimental study on 1500 schoolchildren aged 6 to 12 years to investigate the efficacy of yoga in the treatment of kyphosis. A kypholordometer was utilized to determine the existence of kyphosis in the chosen subjects. 24 of the 1500 pupils were discovered to have kyphosis, a postural disorder. These 24 schoolchildren were chosen as a sample. The three-month yoga curriculum consisted of yoga, kriya, and pranayam, or asanas in supine, prone, and sitting postures. Regular yoga practices lasting one hour per day, five days a week, were found to be useful in treating, managing, and avoiding postural problems. It was demonstrated that postural abnormalities in the spinal column improved significantly after the use of yoga and remedial exercise[(20)].

Gail A. Greendale (2002) studied to find out if yoga helps older men and women with adult-onset hyperkyphosis who have kyphosis. The active treatment group participated in hour-long yoga classes three days a week for 24 weeks. Yoga participants' flexicurve kyphosis angle improved by 4.4% when compared to control subjects. Stretching, strengthening, and flexibility led to an improvement in postural awareness and posture (I think I'm standing straighter; the more I practice yoga, the more I remember to sit and stand properly).Therefore, in my studies, yoga was used to treat postural kyphosis, which has improved among college students [(21)].

The result of this study suggests that schroth based exercise with modified classical yoga is effective in treating postural kyphosis among college students.

From above discussion, the result of the study suggest that schroth based exercise when combined with modified classical yoga is effective in reducing thoracic kyphosis angle and improve kyphotic appearance among college students with postural kyphosis

7. Conclusion

After analyzing the results and discussion, it is concluded that a combination of Schroth-based exercise, along with modified classical yoga (Group A), is more effective in reducing the kyphosis angle and improving the appearance of college students with postural kyphosis. This treatment was found to be effective over a period of 6 weeks.

8. References

[1]. Kamali, F., Shirazi, S. A., Ebrahimi, S., Mirshamsi, M., &Ghanbari, A. (2016). Comparison of manual therapy and exercise therapy for postural hyperkyphosis: a randomized clinical trial. *Physiotherapy theory and practice*, *32*(2), 92-97.

[2]. Garoflid, N., Fragniere, B., &Dutoit, M. (2000). "Round back" in children and adolescents. *Revue Médicale de la Suisse Romande*, *120*(10), 815-820.

[3]. Briggs, A. M., Wrigley, T. V., Tully, E. A., Adams, P. E., Greig, A. M., &Bennell, K. L. (2007). Radiographic measures of thoracic kyphosis in osteoporosis: Cobb and vertebral centroid angles. *Skeletal radiology*, *36*, 761-767.

[4]. Roghani, T., Zavieh, M. K., Manshadi, F. D., King, N., &Katzman, W. (2017). Age-related hyperkyphosis: update of its potential causes and clinical impacts—narrative review. *Aging clinical and experimental research*, *29*, 567-577.

[5].Seidi F, Rajabi R, Ebrahimi I, Alizadeh MH, MinoonejadH.The efficiency of corrective exercise interventions on thoracic hyper-kyphosis angle. J Back MusculoskeletRehabil. 2014;27(1):7-16.

[6]. Katzman, W. B., Wanek, L., Shepherd, J. A., &Sellmeyer, D. E. (2010). Age-related hyperkyphosis: its causes, consequences, and management. *Journal of Orthopaedic& Sports Physical Therapy*, *40*(6), 352-360.
[7]. Kamaci, S., Yucekul, A., Demirkiran, G., Berktas, M., &Yazici, M. (2015). The evolution of sagittal spinal alignment in sitting position during childhood. *Spine*, *40*(13), E787-E793.
[8]. Koelé, M. C., Lems, W. F., &Willems, H. C. (2020). The clinical relevance of hyperkyphosis: a narrative review. *Frontiers in endocrinology*, *11*, 5.
[9]. O'Sullivan, P. B., Grahamslaw, K. M., Kendell, M., Lapenskie, S. C., Möller, N. E., & Richards, K. V. (2002). The effect of different standing and sitting postures on trunk muscle activity in a pain-free population. *Spine*, *27*(11), 1238-1244.
[10]. Perriman, D. M., Scarvell, J. M., Hughes, A. R., Ashman, B., Lueck, C. J., & Smith, P. N. (2010). Validation of the flexible electrogoniometer for measuring thoracic kyphosis. *Spine*, *35*(14), E633-E640.
[11]. Teixeira, F. A., &Carvalho, G. A. (2007). Reliability and validity of thoracic kyphosis measurements using flexicurve method. *Brazilian Journal of Physical Therapy*, *11*, 199-204.
[12]. Lehnert-Schroth, C. (1992). Introduction to the three-dimensional scoliosis treatment according to Schroth. *Physiotherapy*, *78*(11), 810-815.
[13]. La Forge, R. (1997). Mind-body fitness: encouraging prospects for primary and secondary prevention. *Journal of Cardiovascular Nursing*, *11*(3), 53-65.
[14].Choi, S. A., Cynn, H. S., Yi, C. H., Kwon, O. Y., Yoon, T. L., Choi, W. J., & Lee, J. H. (2015). Isometric hip abduction using a Thera-Band alters gluteus maximus muscle activity and the anterior pelvic tilt angle during bridging exercise. *Journal of Electromyography and kinesiology*, *25*(2), 310-315.
[15].Zapata, K. A., Jo, C., Carreon, L. Y., & Johnston, C. E. (2021). Reliability and validity of a kyphosis-specific spinal appearance questionnaire. *Spine deformity*, *9*, 933-939.
[16].Bezalel, T., Carmeli, E., Levi, D., &Kalichman, L. (2019). The effect of Schroth therapy on thoracic kyphotic curve and quality of life in Scheuermann's patients: a randomized controlled trial. *Asian spine journal*, *13*(3), 490.
[17].Bezalel, T., &Kalichman, L. (2015). Improvement of clinical and radiographical presentation of Scheuermann disease after Schroth therapy treatment. *Journal of Bodywork and Movement Therapies*, *19*(2), 232-237.
[18].Abd-Eltawab, A. E., & Ameer, M. A. (2021). The efficacy of Theraband versus general active exercise in improving postural kyphosis. *Journal of Bodywork and Movement Therapies*, *25*, 108-112.
[19].Shin, A. R., Lee, J. H., Kim, D. E., &Cynn, H. S. (2018). Thera-band application changes muscle activity and kyphosis and scapular winging during knee push-up plus in subjects with scapular winging: the cross-sectional study. *Medicine*, *97*(14), e0348.
[20].Dhokrat, B. G., &Dhokrat, G. K. EFFICACY OF YOGA IN MANAGEMENT OF KYPHOSIS IN SCHOOL CHILDREN: AN EXPERIMENTAL STUDY.
[21].Greendale, G. A., Huang, M. H., Karlamangla, A. S., Seeger, L., & Crawford, S (2009). Yoga decreases kyphosis in senior women and men with adult-onset hyperkyphosis: results of a randomized controlled trial. *Journal of the American Geriatrics Society*, *57*(9), 1569-1579.