

Effect of Pilates on Upper Limb & Lower Limb Flexibility in School Children – An Experimental Study

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ABSTRACT

Introduction: Flexibility in children is key to maintaining good physical health and preventing injuries, making it an essential component of their fitness routine. The initial literatures of pilates were limited to improve posture and core strengthening. Recent articles have shown that pilates exercise has an effect on improving flexibility as well. Considering long time sitting to be a current problem and increasing evidences on physical fitness being related to future problems to children and adolescent, there is more to research on this population. Thus, this study aims to find the effectiveness of pilates exercise on flexibility in school children.

Method: Sixty children were approached out of which fifty-three children consented for assessment and intervention. Their upper limb flexibility was measured by Apley's scratch test and lower limb flexibility was assessed by sit & reach test.

Results: Wilcoxon's test was used to statistically analyzed upper limb flexibility and paired t test was used to statistically analyzed lower limb flexibility. Both the test showed significant result with $p < 0.001$.

Conclusion: This study confirms that Pilates exercise are effective to increase upper limb and lower limb flexibility in school children.

Keywords: Upper limb flexibility, lower limb flexibility, Pilates exercise.

INTRODUCTION

Flexibility is ability to rotate a single joint or series of joints smoothly through unrestricted, painful free range of motion and is highly specific to each of the joints of body. ⁽¹⁾ Flexibility depends on use of particular joint or body part. Benefits of flexibility include better range of motion and function, prevention and reduction of injury risks, neck tension, improves athletic performance and improves co-ordination. Flexibility may contribute to improved physical performance, reduced energy requirements for movement of joints

because of reduced tissue tension and reduced likelihood of soreness or injury with physical exercise. The basic structure of the skeleton is genetically determined, but its final mass and architecture is influenced by mechanisms sensitive to mechanical loading. This raises serious questions about the long-term effects of mechanical loading on growing bones and decreasing flexibility.

Pilates exercise are core exercises with breathing control to improve flexibility, posture, strengthen muscles and balance. Pilates designed a comprehensive method of

muscle stretching and strengthening with the goal of building a strong body under the philosophy of mind-over-body control. Body weight is the main resistance that is used throughout the series of Pilates mat exercises. Pilates encourages the slight forward flexion of the cervical vertebra, the stabilization of the scapula, the “connection” of the rib cage to the hips and the posterior pelvic tilt. Efficient organization of head, neck, and shoulder girdle as cued with each exercise, allows the Pilates participant to coordinate the placement of the lower body to achieve maximal muscular contraction.⁽¹⁸⁾ It is a type of structured physical activity that can be applied to any population, including children and adolescents, and can be easily inserted into the school environment.⁽³⁾ Pilates can help children to grow stronger and improve their flexibility. Pilates could be a preventive exercise proposed for children at risk of developing postural changes and pain due to daily activities such as watching television, sitting posture, and carrying the school backpack.⁽⁴⁾ Pilates can be enjoyable for children as each exercise will be repeat for 10 times in rhythm with commands by therapist also, children can gain awareness of their body, and learn how to move efficiently and gracefully. As children grow, their bodies are in a constant state of change and development.

MATERIALS & METHODS

An Experimental study was conducted in the schools of pune city. Study was approved by the ethical committee. School children from 9 to 14 years of age were randomly selected for the study. For study 5 schools were approached.

Students of 5th, 6th, 7th&8th were included from each school, according to inclusion and exclusion criteria.

Once the child was selected, he/she was asked history of any diagnosed musculoskeletal, neurological, cardiorespiratory disease. Based on this, 10

children were excluded from the study. The others (n=53) were given the consent and the assent forms.

The demographic data including name, age, standard and gender were noted.

The flexibility was measured by apley’s scratch test and sit & reach test using measuring tape and mat.

For apley’s scratch test, child was asked to stand and raise right arm over the head. Then, bend the left elbow. using left hand, reach down behind back and rest the back of hand on your spine. Without straining, slide right hand down to neck and left hand up to spine. Once child have reached as far as he/she can, the examiner measured the distance between fingers.

For sit & reach test, child was asked to sit on the mat with their legs straight and their feet was placed against the measuring tape. Ask them to keep their hands flat, one on top of the other, with their palms facing down and to reach forward as far as possible with their arms stretched out in front while keeping their knees straight. After assessment those who had poor and average score, they were selected for pilates protocol.

Pilates protocol was done for 4 weeks (3 days/week) on 53 students. Exercise protocol of Pilates Session will be Lasted for One Hour and Commenced with 10 Minutes Warm Up and will Finished with 10 Minutes of Cool Down.

Warm up exercises include neck flexion, neck extension, neck rotation, shoulder circumduction, trunk rotation, knee flexion, calf raises & loose jumps each of 10 repetitions.

Cool down exercises include stretching of large muscle groups & savaasana.

Main pilates protocol was started with pilates warmup protocol include hip release, spinal rotation, cat stretch, hip rolls & scapula isolation each for 5 repetitions.

Pilates exercise protocol include Ab prep, hundreds, breaststroke, double leg stretch, saw, roll over, spine twist & scissors each for 5 repetitions.

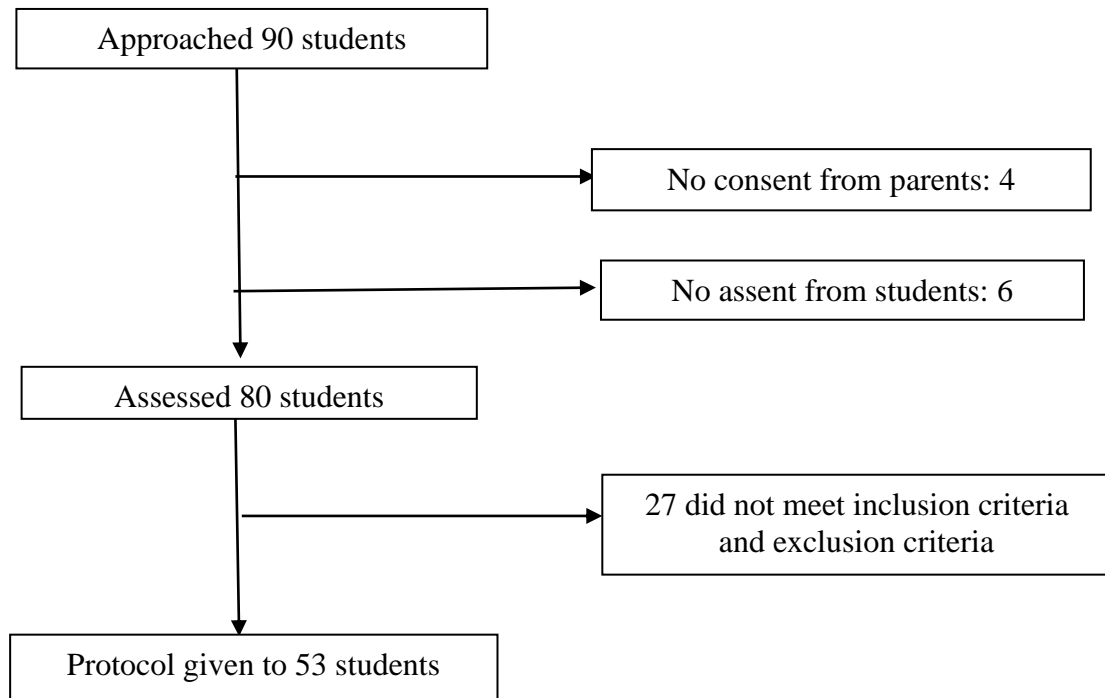


Figure 1: Procedure Of Protocol



FIGURE 2: APLEY'S SCRATCH TEST



FIGURE 3: SIT&REACH TEST



Figure 4: Warm Up Exercises



Figure 5: Pilates Warm Up Exercises



Figure 6: Pilates Exercises



Figure 7: Cool Down Exercises

DATA ANALYSIS & RESULT

The present study was aimed at finding the effect of Pilates on flexibility in school children after 4 weeks protocol.

The data was analyzed using Microsoft excel sheet and GraphPad. Total 53 students, both male (33) and female (18) were selected according to the inclusion and

exclusion criteria. Various statistical measures such as mean, standard deviation (SD) and test of significance were utilized to analyze the data. Wilcoxon's test was used to statistically analyzed upper limb flexibility and paired t test was used to statistically analyzed lower limb flexibility. Both the test showed significant result with $P < 0.001$.

There was pre value (1.49 ± 0.50) and post value (3.35 ± 0.60) for Apley's scratch test, pre value (16.2 ± 2.0) and post value (22.7 ± 2.8) for sit & reach test.

Hence the results showed that Pilates exercise was effective in improving the flexibility in school children after 4 weeks.

1. AGE DISTRIBUTION:

53 students from age group 9 to 14 were selected according to inclusion and exclusion criteria and data analysis was done.

2. GENDER DISTRIBUTION:

53 students, from age group 9 to 14 were selected according to inclusion and exclusion criteria and data analysis was done. In the total 56 count, 33 were males and 18 were female.

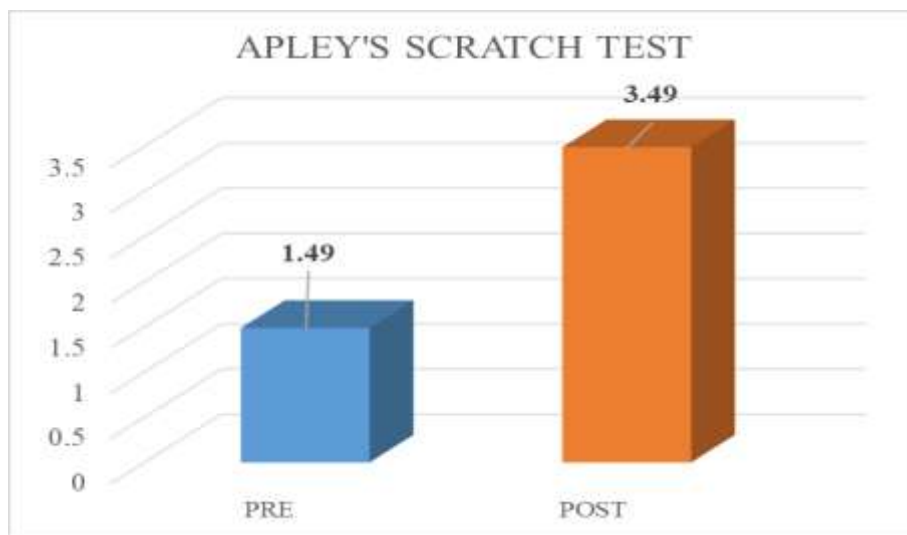


Figure No 8: Comparison Of Pre and Post Values of Apley's Scratch Test

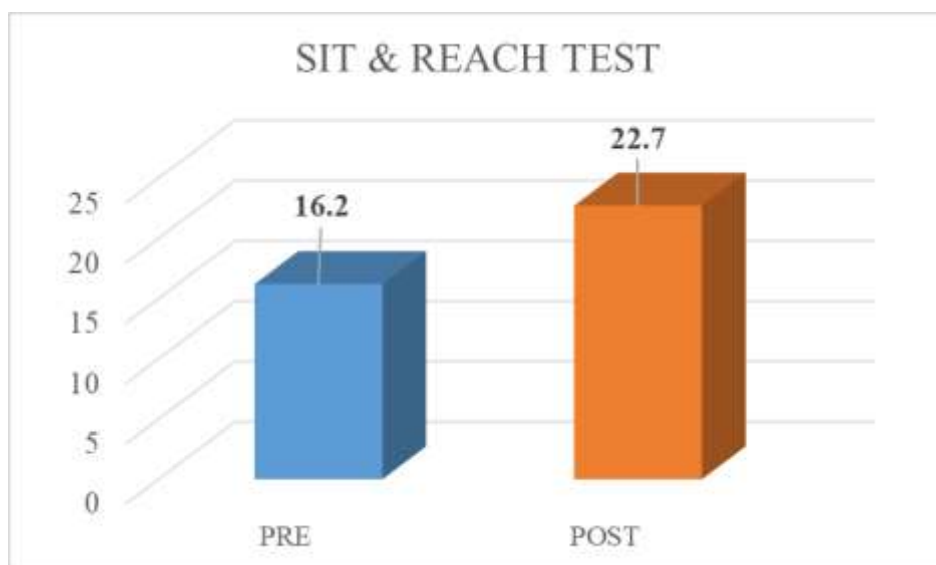


Figure No 9: Comparison Of Pre and Post Values of Sit & Reach Test

DISCUSSION

The present study represents potential mechanism associated with response to an intervention that incorporates Pilates exercise to improve flexibility in school children. Pilates exercise method is combination of simple, repetitive exercises to create muscular exertion. These exercises are composed to increase muscle strength and endurance as well as flexibility.⁽⁶⁾

Forward lean posture is associated with low back pain and decreased flexibility of upper limb and lower limb too. Good posture is important in preventing low back pain. Poor posture and muscle imbalance fatigues the body and places extra stress on the spine that causes muscular aches and pains. Pain for longer time leads to decrease movement, decrease in range of motion and decrease in flexibility. Non symmetric carriage and backpack straps over both shoulders leads to decreased upper limb flexibility. When the body is aligned it is balanced and able to absorb stress evenly and efficiently.

postural change and flexibility to be a central theme in the negative physiologic effects that occur in children, i.e., decreased respiratory function and kyphosis, increasing cardiovascular demand that is required to balance a load off center. The inclined body position decreased flexibility and the altered locomotion biomechanics on a daily basis would increase the stresses on the back and leg muscles. For young children, these stresses might be harmful and influence their normal musculoskeletal developmental growth. Pilates is eccentric contraction type exercise which commonly train slow twitch muscle fibers which are activates by low intensity, sustained movements. Pilates method is combination of static and dynamic stretching exercises which are safe to provide an increasing flexibility.⁽¹⁶⁾ When Pilates position is applied, soft stretch to tissues and muscles activates Golgi tendon organ which results in lengthening of sarcomeres. Golgi tendon organ inhibits alpha motor neuron activity as a result of decreased tension in muscles, permitting sarcomeres to lengthen.

Repetitive stress will increase the plastic deformation of tissues in the elastic range, allowing gradual rearrangement of the collagen fibers.⁽¹⁸⁾

Flexibility assessment should be considered as a useful marker of health throughout childhood and adolescents, which would have an impact on adulthood as well. This study also throws a light on pilates exercise which helps not only for improving flexibility but it improves and maintains body structures. This study justifies and supports the idea of adding pilates exercise protocol as part of the physical education into the regular study curriculum.

Since, no adverse effects occurred and dropout rates for motivated reasons was none, Pilates exercise seemed to be feasible as well as safe and acceptable in the sample of present study.

According to Sureeporn Phrompaet and Aatit Paungmali, this study provides remarkable insight into the potential benefits of Pilates exercise for flexibility. The Pilates exercise prescription in this study was successful to enhance flexibility component in agreement with flexibility exercise prescription by ACSM. (Effects of Pilates training on lumbo-pelvic stability and flexibility).⁽¹⁶⁾

This study confirms that Pilates exercise is effective to increase upper limb and lower limb flexibility in school children.

This study has a limitation that, in some schools due to lack of time, group sessions were conducted for students rather than individual session.

In future, study can be done between male and female as comparative study, also population can be changed and other age groups can be considered.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Jessica albert, 4 Health Benefits of Pilates for Kids [Internet]. 2023. Available from: https://www.momjunction.com/articles/benefits-of-pilates-for-kids_00330079/
2. Mr. Soumya Ghosh, Mr. Ashoke Mukherjee, Ph.D. Effect of Pilates Training on Core Muscles and BMI of Obese Children: A Pilot Study., *J Adv Sport Phys Edu*, May, 2022; 5(5)
3. Effectiveness of mat pilates on postural alignment in the sagittal plane in school children Cibinello FU, Neves JC, Carvalho MY, Valenciano PJ, Fujisawa DS. Effectiveness of mat Pilates on postural alignment in the sagittal plane in school children: a randomized clinical trial. *Motriz: Revista de Educação Física*. 2020 Dec 14;26. <https://doi.org/10.1590/S1980-6574202000040053>
4. Elizabeth A. Hornsby. Evaluating the Impact of a Pilates Intervention on Physical Function in Children with Hypermobility Spectrum Disorder: A Study Protocol Using Single-Case Experimental Design. *Open Journal of Pediatrics*. , Vol.11 No.1, March 2021
5. Sandie keane. Pilates for core strength – 1st edition
6. Roger Brignell., *The Pilates Handbook – 1st edition*
7. Elizabeth Quinn, MS., How to Perform the Apley Scratch Test Assess Range of Motion in Your Shoulders [Internet]. Updated on May 25, 2021. Available from: <https://www.verywellfit.com/shoulder-flexibility-test-3120278>
8. Jenna Cartwright. The 6 Best Pilates Exercises for Your Upper Body [Internet]. Available from: <https://sportandspinalphysio.Com.Au/the-6-best-pilates-exercises-for-your-upper-body/>
9. Committee on Fitness Measures and Health Outcomes in Youth; Food and Nutrition Board; Institute of Medicine., *Fitness Measures and Health Outcomes in Youth*., 2012 Dec 10
10. Zengin Alpozgen A, Razak Ozdinciler A, Karanlik H, Yaman Agaoglu F, Narin AN. Effectiveness of Pilates-based exercises on upper extremity disorders related with breast cancer treatment. *European journal of cancer care*. 2017 Nov;26(6): e12532.
11. Emery K, De Serres SJ, McMillan A, Côté JN. The effects of a Pilates training program on arm–trunk posture and movement. *Clinical Biomechanics*. 2010 Feb 1;25(2):124-30.
12. Dr. Parul Rakholiya, Dr. Hanee Patel, Dr. Vishwa Patel and Dr. Ridhi Patel., Effect of prolonged sitting on hamstring flexibility on schoolchildren: An observational study., *International Journal of Applied Research* 2021; 7(1): 348-353.
13. The effect of backpack weight on the height of middle school students, Shuman, Barbara Dixon, "The effect of backpack weight on the height of middle school students" (2003). Theses Digitization Project. 2172. <https://scholarworks.lib.csusb.edu/etd-project/2172>
14. Neil A Segal¹, Jane Hein, Jeffrey R Basford., The effects of Pilates training on flexibility and body composition: an observational study; *Arch Phys Med Rehabil*.,2004 Dec;85(12):1977-8
15. Carolyn Kisner, PT, MS; Lynn Allen Colby, PT, MS., *Therapeutic exercise – foundation & techniques*., Sixth Edition.
16. Effects of pilates training on lumbo-pelvic stability and flexibility :sureeporn phrompaet, Phrompaet S, Paungmali A, Pirunsan U, Sitalertpisan P. Effects of pilates training on lumbo-pelvic stability and flexibility. *Asian J Sports Med*. 2011 Mar;2(1):16-22. doi: 10.5812/asjasm.34822. PMID: 22375213; PMCID: PMC3289190.
17. Flexibility: a multi-disciplinary literature review and a research agenda for designing flexible engineering systems.; https://www.researchgate.net/publication/245326069_Flexibility_A_Multi-disciplinary_Literature_Review_and_a_Research_Agenda_for_Designing_Flexible_Engineering_Systems
18. Pamela K Levangie, Cynthia C Norkin., *Joint Structure and Function: A Comprehensive Analysis*., 5th edition
19. The role of cognitive flexibility in young children's potential for learning under dynamic testing conditions femke E. Stad, karl H. Wiedl, https://www.researchgate.net/publication/324369843_The_role_of_cognitive_flexibility_in_young_children's_potential_for_learning_under_dynamic_testing_conditions
20. Coelho JJ, Graciosa MD, de Medeiros DL, Pacheco SC, da Costa LM, Ries LG. Influência da flexibilidade e sexo na postura de escolares [Influence of flexibility and

gender on the posture of school children].
Rev Paul Pediatr. 2014 Sep;32(3):223-8.
doi: 10.1590/0103-0582201432312. Epub
2014 Oct 3. PMID: 25479853; PMCID:
PMC4227344.

21. Hornsby E, Johnston LM. Effect of Pilates Intervention on Physical Function of Children and Youth: A Systematic Review. Arch Phys Med Rehabil. 2020 Feb;101(2):317-328. doi:

10.1016/j.apmr.2019.05.023. Epub 2019
May 30. PMID: 31152703.

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