

Original Research Paper

The effectiveness of core stabilization and schroth exercise on pain reduction in adolescents with scoliosis

Fitriani Fitratilla^{1,a*}, Fitri Yani^{1,b}, Danur Setiawan^{1,c}

¹ Universitas Aisyiyah Yogyakarta, Jl. Siliwangi Jl. Ringroad Barat No.63, Area Sawah, Nogotirto, Gamping, Sleman, Daerah Istimewa Yogyakarta Indonesia 55592

^afitrianifitratilla02@gmail.com*, ^bfitriyani_17@unisayogya.ac.id, ^cdanursetiawan70@gmail.com

Submitted: 7 January 2024

Revised: 10 February 2024

Accepted: 29 March 2024

Abstract

Background: Disorders of the spine, such as scoliosis, kyphosis, and lordosis, are often complained about by many people. Currently, disorders of the spine are not only limited to adults and the elderly. They can also affect children and adolescents, where the prevalence of adolescent idiopathic scoliosis in the world ranges from 0.47% to 5.2%. The spine has a crucial role in human movement activities, playing a role as a support and enforcer of the body. In this regard, appropriate intervention for people with scoliosis is very important to be carried out. **Objective:** To find out how effective core stabilization and schroth exercise are at reducing pain in scoliosis in adolescents aged 13-15 years. **Research Method:** The type of research used is quasi-experimental research with a pre-test and post test two-group design. **Results:** After 4 weeks of intervention with a frequency of two times a week, there was a significant reduction in scoliosis pain in adolescents. Both models of exercise core stabilization and schroth exercise – are equally effective. **Suggestion:** The researcher is expected to expand this research by increasing the number of samples and extending the duration of the study.

Keywords: Scoliosis; Core Stabilization; Schroth Exercise

1. Introduction

The spine has a crucial role in human movement activities. It plays a role as a support and enforcer of the body. The task of the spine is very heavy because, in addition to serving as a support for the body, it also has to bear about two-thirds of the total body weight. Disorders of the spine, such as scoliosis, kyphosis, and lordosis, are often complaints experienced by many people. It is important to note that disorders of the spine are not only in adults and the elderly, but can also be in groups of children and adolescents, making them vulnerable to posture problems related to the spine (Dwi Setiyawati & Hendrawan, 2020). Scoliosis currently does not only occur in adults and the elderly. The incidence rate of scoliosis is quite high also among adolescents. Data shows that the prevalence of adolescent idiopathic scoliosis in the world ranges from 0.47% to 5.2%. The ratio of girls to boys ranges from 1.5:1 to 3:1 and increases substantially with age. (Konieczny et al., 2013). In Indonesia, the prevalence of cases is around 4-4.5% of adolescents affected by idiopathic scoliosis (Choudhry et al., 2016). The incidence rate of adolescent idiopathic scoliosis in Surabaya is estimated to be around 2.93%, with a ratio of 4.7:1 between women and men (Komang-Agung et al., 2017). The incidence of scoliosis in private schools is higher, at around 2.5%, while in public schools it is only around 0.5% (Nabilah et al., 2022).

One of the reasons for the high incidence rate in adolescents is, that during the growth period, the skeleton grows faster than muscles, making the spine more susceptible to various factors, such as injury, lifestyle, and abnormal posture (Negrini et al., 2018). The gradual rate of scoliosis development can be

seen at the age of 10-12 years or the last year before menarche with an increase in the angle of 10-15 degrees per year (Baedlowi, 2015). Juvenile idiopathic scoliosis is defined as a lateral curvature of the spine (Cobb Angle) of at least >10 degrees, in the absence of congenital abnormalities or underlying neuromuscular disorders (Kuznia et al., 2020). The initial symptoms of scoliosis do not show obvious physical signs. However, when the severity increases to moderate or even severe, physical symptoms begin to appear, including shoulder asymmetry, a body that looks tilted to one side, one hip is more prominent, the scapula appears more prominent on one side. In addition to these physical changes, people with scoliosis also experience several symptoms, such as pain, fatigue when sitting or standing for long periods of time, imbalance between the shoulders or feeling that one shoulder is higher than the other (Nabilah et al., 2022).

One of the problems that is very disturbing in people with scoliosis is the pain that arises. Although scoliosis was previously thought to be painless, some studies have shown that individuals with scoliosis have a higher risk of developing back pain (Balagué & Pellisé, 2016). The severity of pain in juvenile idiopathic scoliosis is often reported with moderate to severe intensity (Thérout et al., 2015), and the most frequent location of pain is in the thoracolumbal region (Thérout et al., 2017). Factors that affect pain include age, body mass index, cobb angle, curve type, appearance, and mental health (Lau et al., 2023). Epidemiological studies and natural history show that back pain is more frequent, severe, and longer in duration in AIS than in adolescents without AIS (An et al., 2023).

Inappropriate treatment of scoliosis can lead to serious deformities in the structure of the spine, chest, and back, which can disrupt the body's biomechanical mechanisms, limit lung capacity, and reduce a person's physical ability, productivity, and quality of life (Negrini et al., 2018). Therefore, it is important to consider appropriate treatment in the early stages, especially during the growth period, i.e. during puberty, to prevent the development of scoliosis (Schreiber et al., 2016). Non-surgical scoliosis interventions include preventing or reducing the development of curvature during puberty, reducing or treating respiratory distress, reducing or treating back pain, and improving the patient's appearance with posture corrections (Negrini et al., 2018). One of the non-surgical interventions that can be done in patients with scoliosis is by providing exercise to reduce the pain caused. Physiotherapy is a form of health service aimed at individuals and/or groups to develop, maintain and restore movement and body functions throughout the life cycle by using manual handling, improvement of movement, equipment (physical, electrotherapeutic and mechanical) functional training and communication (Permenkes No. 80, 2013:3).

Core stabilization is a method that involves training local core muscles (transverse, multifidus and diaphragm muscles) in a static position to global muscle stability training (internal and external oblique abdominal muscles). The mechanism of core stabilization in lowering pain by improving body balance and reducing postural asymmetry, so that the core muscles limit compression (pressure), distortion (shift), and spinal rotation (Dimitrijević et al., 2022). Schroth exercise is defined as a method that involves sensorimotor, postural, and breathing exercises with the aim of realigning posture naturally, controlling posture stability in static and dynamic states, reducing pain, and maintaining spinal stability (Schreiber et al., 2016). The mechanism of schroth exercise lowers pain by focusing on improving the balance of the muscles of the trunk including the abdominal muscles, paraspinal muscles, iliacus muscles, quadratus lumborum muscles, latissimus dorsi muscles, and so on. This exercise program encourages exercise specifically to reduce spinal pain and increase spinal muscle strength (Jokar & Mostamand, 2018). The purpose of this study is to find out how effective core stabilization and schroth exercise are in reducing pain in adolescent scoliosis patients aged 13-15 years.

2. Research Method

This research refers to a quantitative approach. The type of research used in this study is quasi-experimental research with a pre-test and post-test design of two groups. This study aims to find out

whether there is an effect of core stabilization and schroth exercise on pain reduction in scoliosis aged 13-15 years. This study used two treatment groups : treatment group 1 was given core stabilization and treatment group 2 was given schroth exercise. This research has received an ethical test with number 3300/KEP-UNISA/XII/2023.

3. Results and Discussion

3.1. Respondent Characteristics

Table 1. Sample Characteristic by Age

Age	Group 1		Group 2	
	Frequency	%	Frequency	%
13 years	3	15,0	3	15,0
14 years	3	15,0	3	15,0
15 years	4	20,0	4	20,0
Total	10	50,0	10	50,0

Table 1 explains the respondents based on the age characteristics. In all treatment groups, the highest number was at the age of 15 years at 20% in both the treatment group and the control group. The gradual rate of scoliosis development can be seen at the age of 10-12 years or the last year before menarche with an increase in the angle of 10-15 degrees per year (Baedlowi, 2015). In adolescence between 13-15 years old, there is a very rapid growth of the body, especially in the spine. This unbalanced growth process can lead to spinal misalignment and trigger the onset of scoliosis. The prevalence of scoliosis is higher during the years of puberty or increases with age (Hengwei et al., (2016).

Table 2. Sample Characteristic by Body Mass Index (BMI)

Body Mass Index (BMI)	Group 1		Group 2	
	Frequency	%	Frequency	%
Thin <18,5	4	20,0	2	10,0
Normal 18,5 – 24,9	5	25,0	7	35,0
Obese 25 – 29,9	0	0	1	5,0
Obese >30	1	5,0	0	0
Total	10	50,0	10	50,0

Table 2 describes the respondents based on the characteristics of Body Mass Index. Base on the table, it was found that in all groups, most of the respondents had a normal body mass index, which was 25% in group I and 35% in group II. Body Mass Index is one of the triggering factors for scoliosis, especially in people with abnormal BMI such as being too thin or too obese. However, some studies have stated that Body Mass Index does not significantly affect the incidence of Scoliosis (Eufrasia Victa Swastika Anggriasti & Maria Regina Rachmawati, 2016) , Dou et al., (2023). BMI as an anthropometric variable may still play a role, but it is not statistically proven in research. Other factors such as physical activity are more dominant in influencing the incidence of scoliosis than BMI according to the results of the study.

3.2. Effectiveness of Core Stabilization on Pain in People with Scoliosis

Table 3. Hypothesis Test 1

Sample	n	Mean \pm SD	p
Group 1	10	2.600 \pm 0,699	0,000

Based on the results of the analysis test, as shown in the above table, core stabilization was effective in reducing pain in scoliosis patients. This is in line with the research of Gür et al.(2017), which stated that core stabilization has an effect on reducing pain in adolescent idiopathic scoliosis. The mechanism of core stabilization in reducing pain in juvenile idiopathic scoliosis (AIS), involves core stabilization training to improve the strength and stability of global and local muscles around the spine. In the study, core stabilization training was found to improve the SRS-22 pain domain, which suggests that stabilization training improves global muscles and their ability to balance the load on the body. In addition, stabilization training also develops the ability of local muscles to maintain strength control within the spine. With pain-free movements gained through core stabilization training, individuals can gain the confidence to use their spine for physical activity and improve their quality of life. This is also in line with the research of Yagci & Yakut, (2019) which states that core stabilization is superior in pain reduction compared to other treatments. Core stabilization exercises develop the ability of the core muscles to restore dynamic control of external and internal forces in the spine and improve spinal stability. This can reduce the load and pressure on the muscles and joints, so it can reduce pain.

3.3. Effectiveness of Schroth Exercise on pain in scoliosis patients

Table 3. Hypothesis Test 1

<i>Sample</i>	<i>n</i>	<i>Mean ± SD</i>	<i>p</i>
Group 2	10	2.800 ± 0,632	0,000

Based on the results of the analysis test as shown in table 4, core stabilization is effective in reducing pain in scoliosis patients. This is in line with the research of Fatih izzulhaq et al., (2022) which stated the results of the journal's research, that schroth exercise has an effect on reducing pain. Schroth Exercise works to curve or reposition the spine back to a more normal position so that it has an effect on posture improvement. Schroth exercise aims to rotate, lengthen, and stabilize the spine in a three-dimensional plane, which can reduce the load and pressure on muscles and joints, thereby reducing pain. In addition, there was an improvement in functional items and self-image after the schroth exercise.

This is not also different with the research of H. J. Lee et al., (2016) which showed the benefits of schroth exercise on pain reduction with idioaptic scoliosis. The Schroth method works to improve posture by straightening, derotating, and deflecting the spine. The Schroth method also provides sensorimotor and kinesthetic stimulation to correct abnormal breathing patterns in scoliosis patients. The active holding emphasized in the Schroth method aims to obtain mobility and stability again. The repetitive exercise component provides continuous visual feedback on correct posture. It can be concluded that the pain reduction mechanism occurs due to improved posture, body mechanics, muscle and spine stability, as well as awareness of normal posture after the administration of the Schroth method intervention with emphasis on active grip.

3.4. Difference between core stabilization and schroth exercise effectiveness tests on scoliosis pain

Table 4. Hypothesis Test III

<i>Sample</i>	<i>Group I</i>	<i>Group II</i>	<i>p</i>		
<i>Post VAS</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
<i>Group I & Group 2</i>	2,30	0,675	2,20	0,789	0,635

The results of the statistical test in Table 4 is clearly that in the treatment group, core stabilization and schroth exercise are equally effective in reducing pain in scoliosis patients. This is in line with the

research of Dimitrijević et al., (2022) which showed that core stabilization and schroth exercise had no difference in influence between the two. Both the Schroth method and core stabilization exercises showed positive effects in reducing Cobb angle, limb rotation angle, and improving the quality of life of idiopathic scoliosis patients. This suggests that both types of interventions are beneficial for the management of scoliosis. No significant difference was found between the influence of Schroth's method and core stabilization exercises. Although the analysis of the subgroups showed the Schroth method was more effective, the difference was not large enough to be considered statistically different.

This is also similar with the research of Siolimbona & Irfan, (2021) which showed that there was no difference in the effect of core stabilization and schroth exercise on adolescent idiopathic scoliosis. In this case, both core stabilization and schroth exercise both focus on training posture stabilization muscles because of their similar training goals and principles. The population, duration and intensity given to both groups were similar enough that the effects obtained were almost the same. So there is no significant difference between the two methods.

4. Conclusion

After 4 weeks of intervention with a frequency of two times a week, there was a significant reduction in scoliosis pain in adolescents. Both exercise models core stabilization and schroth exercise are equally effective in reducing pain in scoliosis patients. However, this exercise needs to be further studied whether it can permanently and continuously relieve pain or not. It is hoped that the next researchers can expand their research by increasing the number of samples and extending the duration of the research.

Acknowledgements

Thank you to Aisyiyah University Yogyakarta for supporting in conducting research

Reference

- An, J. K., Berman, D., & Schulz, J. (2023). Back pain in adolescent idiopathic scoliosis: A comprehensive review. In *Journal of Children's Orthopaedics* (Vol. 17, Issue 2, pp. 126–140). British Editorial Society of Bone and Joint Surgery. <https://doi.org/10.1177/18632521221149058>
- Baedlowi, H. (2015). Hubungan Stadium Risser Sign Dengan Umur Kronologis, Besar Sudut Dan Indeks Fleksibilitas Pasien Aolescent Idiopathic Scoliosis Di Rs Orthopaedi Prof. Dr. R. Soeharso Surakarta [Universitas Sebelas Maret]. <https://digilib.uns.ac.id/dokumen/detail/43908/Hubungan-Stadium-Risser-Sign-Dengan-Umur-Kronologis-Besar-Sudut-dan-Indeks-Fleksibilitas-Pasien-Adolescenta-Idiopathic-Scoliosis-di-Rs-Orthopaedi-Prof-Dr-R-Soeharso-Surakarta>
- Balagué, F., & Pellisé, F. (2016). Adolescent idiopathic scoliosis and back pain. In *Scoliosis and Spinal Disorders* (Vol. 11, Issue 1). BioMed Central Ltd. <https://doi.org/10.1186/s13013-016-0086-7>
- Cheung, Z. B., Selverian, S., Cho, B. H., Ball, C. J., & Kang-Wook Cho, S. (2019). Idiopathic Scoliosis in Children and Adolescents: Emerging Techniques in Surgical Treatment. *World Neurosurgery*, 130, e737–e742. <https://doi.org/10.1016/j.wneu.2019.06.207>
- Choudhry, M. N., Ahmad, Z., & Verma, R. (2016). Adolescent Idiopathic Scoliosis. *The Open Orthopaedics Journal*, 10(1), 143–154. <https://doi.org/10.2174/1874325001610010143>
- Dimitrijević, V., Viduka, D., Šćepanović, T., Maksimović, N., Giustino, V., Bianco, A., & Drid, P. (2022). Effects of Schroth method and core stabilization exercises on idiopathic scoliosis: a systematic review and meta-analysis. In *European Spine Journal* (Vol. 31, Issue 12, pp. 3500–3511). Springer Science and Business Media Deutschland GmbH. <https://doi.org/10.1007/s00586-022-07407-4>
- Dou, Q., Zhu, Z., Zhu, L., Wang, W., Guo, L., Ru, S., Chen, X., Yang, L., Lu, C., & Yan, B. (2023). Academic-related factors and daily lifestyle habits associated with adolescent idiopathic scoliosis: a case-control study. *Environmental Health and Preventive Medicine*, 28(0), 22–00243. <https://doi.org/10.1265/ehpm.22-00243>

- Dwi Setiyawati, & Hendrawan, A. (2020). Upaya Pencegahan Gangguan Tulang Belakang Pada Anak Sekolah Dasar Melalui Program Pelatihan Back School Fisioterapi. *Jurnal Pengabdian Masyarakat Al-Irsyad (JPMA)*, 2(1), 72–78. <https://doi.org/10.36760/jpma.v2i1.82>
- Eufrasia Victa Swastika Anggriasti, & Maria Regina Rachmawati. (2016). Correlation between Body Mass Index and Physical Activity with Scoliosis in Young Adult. *Indonesian Journal of Physical Medicine & Rehabilitation*, 5(02), 38–44. <https://doi.org/10.36803/ijpmr.v5i02.208>
- Fatih izzulhaq, F., Wahyuni, & Ati Hidayati. (2022). Pengaruh Schroth Exercise Terhadap Peningkatan Fungsional pada Anak Penderita Skoliosis: Studi Kasus. *Jurnal Kesehatan Dan Fisioterapi (Jurnal KeFis)*, 2(3).
- Gür, G., Ayhan, C., & Yakut, Y. (2017). The effectiveness of core stabilization exercise in adolescent idiopathic scoliosis: A randomized controlled trial. *Prosthetics and Orthotics International*, 41(3), 303–310. <https://doi.org/10.1177/0309364616664151>
- Hefti, F. (2013). Pathogenesis and biomechanics of adolescent idiopathic scoliosis (AIS). In *Journal of Children's Orthopaedics* (Vol. 7, Issue 1, pp. 17–24). Springer Verlag. <https://doi.org/10.1007/s11832-012-0460-9>
- Hengwei, F., Zifang, H., Qifei, W., Weiqing, T., Nali, D., Ping, Y., & Junlin, Y. (2016). Prevalence of idiopathic scoliosis in Chinese schoolchildren. *Spine*, 41(3), 259–264. <https://doi.org/10.1097/BRS.0000000000001197>
- Jokar, F., & Mostamand, J. (2018). Schroth's Method Exercises for Treating Idiopathic Adolescent Scoliosis; A Narrative Review. *Journal of Research in Rehabilitation of Sciences*, 14(6). <https://doi.org/10.22122/jrrs.v14i6.3353>
- Komang-Agung, I. S., Dwi-Purnomo, S. B., & Susilowati, A. (2017). Prevalence rate of adolescent idiopathic scoliosis: Results of school-based screening in surabaya, Indonesia. *Malaysian Orthopaedic Journal*, 11(3), 17–22. <https://doi.org/10.5704/MOJ.1711.011>
- Konieczny, M. R., Senyurt, H., & Krauspe, R. (2013). Epidemiology of adolescent idiopathic scoliosis. In *Journal of Children's Orthopaedics* (Vol. 7, Issue 1, pp. 3–9). Springer Verlag. <https://doi.org/10.1007/s11832-012-0457-4>
- Kuznia, A. L., Hernandez, A. K., & Lee, L. U. (2020). Adolescent Idiopathic Scoliosis: Common Questions and Answers. *American Family Physician*, 101(1), 19–23. <http://www.ncbi.nlm.nih.gov/pubmed/31894928>
- Lau, K. K. L., Kwan, K. Y. H., Cheung, J. P. Y., Law, K. K. P., & Cheung, K. M. C. (2023). Impact of mental health components on the development of back pain in young adults with adolescent idiopathic scoliosis. *European Spine Journal*. <https://doi.org/10.1007/s00586-023-07908-w>
- Lee, H. J., Seong, H. D., Bae, Y.-H., Jang, H.-Y., Chae, S. H., Kim, K. H., & Lee, S. M. (2016). Effect of the Schroth method of emphasis of active holding on Cobb's angle in patients with scoliosis: a case report. *Journal of Physical Therapy Science*, 28(10), 2975–2978. <https://doi.org/10.1589/jpts.28.2975>
- Nabilah, N. D., Agustin, L., Susilo, T., & Sutandra, L. (2022). Hubungan Karakteristik Dengan Kejadian Skoliosis Pada Siswa Sekolah Menengah Pertama Swasta Al Muslimin Pandan. *Jurnal Kesehatan Dan Fisioterapi (Jurnal KeFis)*, 2(5). <https://pubmed.ncbi.nlm.nih.gov>
- Negrini, S., Donzelli, S., Aulisa, A. G., Czaprowski, D., Schreiber, S., de Mauroy, J. C., Diers, H., Grivas, T. B., Knott, P., Kotwicki, T., Lebel, A., Marti, C., Maruyama, T., O'Brien, J., Price, N., Parent, E., Rigo, M., Romano, M., Stikeleather, L., ... Zaina, F. (2018). 2016 SOSORT guidelines: Orthopaedic and rehabilitation treatment of idiopathic scoliosis during growth. In *Scoliosis and Spinal Disorders* (Vol. 13, Issue 1). BioMed Central Ltd. <https://doi.org/10.1186/s13013-017-0145-8>
- Schreiber, S., Parent, E. C., Moez, E. K., Hedden, D. M., Hill, D. L., Moreau, M., Lou, E., Watkins, E. M., & Southon, S. C. (2016). Schroth physiotherapeutic scoliosis-specific exercises added to the

- standard of care lead to better cobb angle outcomes in adolescents with idiopathic scoliosis - An assessor and statistician blinded randomized controlled trial. *PLoS ONE*, 11(12). <https://doi.org/10.1371/journal.pone.0168746>
- Siolimbona, R., & Irfan, M. (2021). Perbedaan Pengaruh Core Stability dan Schroth Method Terhadap Derajat Kurva pada Adolescent Idiopathic Scoliosis (AIS): Narrative Review. <http://digilib.unisayogya.ac.id/id/eprint/5782>
- Th  roux, J., Le May, S., Fortin, C., & Labelle, H. (2015). Prevalence and Management of Back Pain in Adolescent Idiopathic Scoliosis Patients: A Retrospective Study. *Pain Research and Management*, 20(3), 153–157. <https://doi.org/10.1155/2015/674354>
- Th  roux, J., Le May, S., Hebert, J. J., & Labelle, H. (2017). Back Pain Prevalence Is Associated with Curve-type and Severity in Adolescents with Idiopathic Scoliosis. *Spine*, 42(15), E914–E919. <https://doi.org/10.1097/BRS.0000000000001986>
- Thomas, J. J., Stans, A. A., Milbrandt, T. A., Kremers, H. M., Shaughnessy, W. J., & Larson, A. N. (2021). Trends in Incidence of Adolescent Idiopathic Scoliosis: A Modern US Population-based Study. *Journal of Pediatric Orthopaedics*, 41(6), 327–332. <https://doi.org/10.1097/BPO.0000000000001808>
- Yagci, G., & Yakut, Y. (2019). Core stabilization exercises versus scoliosis-specific exercises in moderate idiopathic scoliosis treatment. *Prosthetics & Orthotics International*, 43(3), 301–308. <https://doi.org/10.1177/0309364618820144>