



# Effectiveness of Klapp Exercise to Treat Angle Currence in Children With Scoliosis: Literature Review

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**Abstract.** *Background:* The most prominent stages of growth and development occur at the age of children and adolescents, namely changes in body posture. Posture changes that occur are caused by environmental factors and spinal growth abnormalities a common abnormality is scoliosis. *Objective:* The researcher aims to determine the effectiveness of klapp exercise in overcoming the curvature of the angle in children with scoliosis conditions. *Research Methods:* This study is a literature review on five articles of the Randomized Controlled Trial (RCT). *Results:* Exercise therapy with the klapp exercise method is effective for reducing the degree of curvature of the angle in scoliosis sufferers and is effective for stabilizing gibbosis and increasing spinal extensor strength. *Conclusion:* Based on the results of a literature review study of five selected articles, exercise therapy using the Klapp method is effective in reducing the degree of curvature of the angle.

**Keywords:** Scoliosis or posture disorder · Scoliosis Idiopathic · Klapp Exercise and Scoliosis · Klapp Exercise or Cat Exercise

## 1 Introduction

The most prominent stages of growth and development occur at the age of children and adolescents, namely changes in body posture. Posture changes that occur are caused by environmental factors and spinal growth abnormalities (Kikanloo et al., 2019). The most common spinal deformity is scoliosis. Scoliosis is the most common spinal deformity in children and adolescents. Scoliosis is often defined as a lateral curvature of the spine that is 10 degrees or greater on coronal radiographs when the patient is in a standing position. The prevalence of diagnosed scoliosis in children with an age range of 10 - 15 years. Scoliosis affects 2–3% of the population in the US or about 7 million people. Based on data from The American Academy of Orthopedic Surgeons, there are about 1.26 million patients with spinal problems in health services and 93% of them are diagnosed with scoliosis. 85% of patients have idiopathic scoliosis and 60% to 80% of cases of idiopathic scoliosis occur in women.

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The prevalence above the study was carried out in elementary school children in Johannesburg (Parera et al., 2016).

The condition of spinal development depends on gender, age, onset, and degree of curvature. The female sex has a higher degree of curvature so that it supports greater development of the spine (Iunes et al., 2010). There are four types of curve patterns that are commonly seen in people with scoliosis, including; in the thorax 90% of the indentations are on the right side, 70% of the lumbar curvature occurs on the left side, 80% of the thoracolumbar indentations occur on the right side and in double major the curve occurs on either the right or left side (Shakil et al., 2014). The problems caused by scoliosis are decreased quality of life, pain, and functional barriers. Since spinal development occurs at an early age and can be exacerbated at a young age, it must be treated as early as possible. Early detection of scoliosis sufferers plays an important role in preventing abnormalities, worsening damage, and to determine signs of spinal curvature, one of which is by using a scoliometer examination or by looking at X-rays measured using the Cobb method (E.Nabila, 2020). Physiotherapy in this case has a role to help stop the increase in curves and reduce the level of curvature in scoliosis sufferers, so the physiotherapy action that can be done is exercise therapy in the form of giving klapp exercise (Sari & Tirtayasa, 2013). The following below are the klapp exercise movements that can be done (Fig. 1).

The Klapp exercise above focuses on stretching and strengthening postures for those with scoliosis problems, besides that, the Klapp movement can build strength, endurance, dexterity and coordination, resulting in overall activation of muscle fibers and can reduce the curvature of the spine (Kurniawati et al. al., 2019). Although the klapp method has little to do with research, this method is often used in the treatment of daily scoliosis because it is easy to apply, can be done individually or even in groups, besides being practical and does not cost money (Fernandes & Pin, 2020). In this exercise, the stretching movement is useful for stretching or lengthening the shortened muscles. In addition,



**Fig. 1.** The combination of klapp exercise movements that can be done, including; 1. Lateral crawl, 2. Horizontal sliding, 3. Crawl posture near the ground, 4. Bunny hopping, 5. Arm turn, 6. Big arch, 7. Lateral crawl near the ground, 8. Big curve.

the strengthening movement is useful for strengthening the muscles in the abdominal, lumbar, and pelvic areas, so that these muscles will contract to regulate posture in the lumbar (Pristianto et al., 2021).

## 2 Method

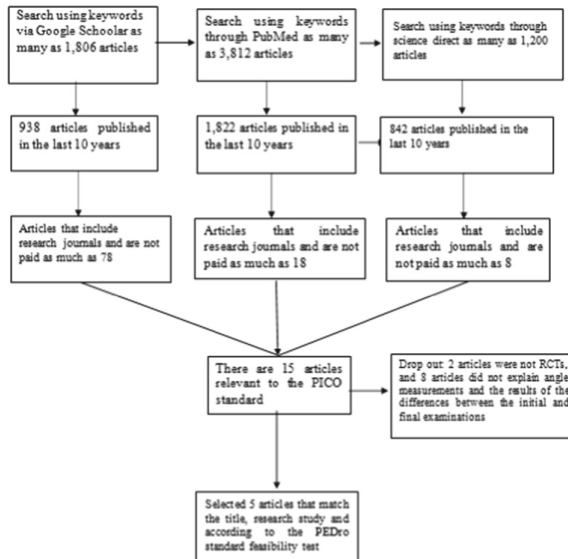
The type of research used in this study is a literature review design that uses the type of Randomized Controlled Trial (RCT) article, which is a design in analyzing and evaluating interventions to show that the interventions used are really feasible and are found in articles and journals. Literature review can be interpreted as a systematic method for identifying, evaluating and synthesizing research works that have been produced by researchers and practitioners (Ulhaq & Rahmayanti, 2020). Evaluation is a process to prove understanding of the text by analyzing its purpose and structure and assessing its suitability with various criteria based on references using PICO. PICO components include: (P) Population is all subjects who are following the unit of analysis. (I) Intervention is a treatment that will be carried out on the unit of analysis to determine its effect. (C) Comparison is a comparison that affects the intervention and control groups in the article. (O) Outcome is the result obtained from the intervention given to the research subject, then the evaluation of the literature in this study uses the appreciative method, namely the PEDro scale. Search data obtained through search engines (search engines) such as the biomedical Database (PubMed), Physiotherapy Evidence Database (PEDro), Google Scholar, and Science Direct with the keywords: Scoliosis or posture disorder, Scoliosis Idiopathic, Klapp Exercise and Scoliosis, Klapp Exercise or Paint Exercise. When selecting a journal there are several inclusion criteria that have been set to make it easier to determine the PICO and the PEDro checklist, including; The selected scientific articles are in the form of free full text published in the last 10 years, scientific articles with the type of randomized controlled trial (RCT), and articles with the PICO standard.

## 3 Results and Discussion

### 3.1 Results

The results obtained from this study have the aim of knowing the level of effectiveness of klapp exercise to reduce curvature of the angle in patients with scoliosis. The results obtained were obtained using the literature review method where articles or journals were obtained using a search engine search in accordance with the inclusion criteria which would then be used as the basis for research (Fig. 2).

Searching keywords from several databases above obtained a total of 6,818 articles. Then filtered based on the last 10 years found a total of 3,602 articles and 3,216 articles published more than the last 10 years, then filtered again based on research journals in the form of free full text as many as 104 articles. The articles obtained were filtered again according to the PICO standard, 15 articles were found. 2 articles did not use the RCT research method and 8 articles did not explain the measurement of angles and the results of differences in the measurement of the initial and final measurements. The final



**Fig. 2.** Article Search Using the PRISMA Method

results that were selected according to the title of the discussion and research study were obtained as many as 5 articles.

The next step is to make a selection using the PEDro scale as a feasibility test that has been determined based on needs and study assessment standards. Articles or journals that have been selected according to the PEDro scale will be the basis for the study in this research which will then be analyzed using the PICO standard. The aim is to determine whether the articles used are appropriate or not to be used as reference material in the research that is being carried out. Table 1 below shows the PICO results from the five selected articles.

Of the five articles that have been selected idiopathic scoliosis is the population in this study where most of the research was conducted on children and adolescents. There are various measuring instruments used in this study including: scoliomeer, dynamometer, biophotogrammetry, and Cobb angle. In addition, there are various kinds of interventions carried out in this study, including: klapp exercise method, vodja, schorth, GPR, self-correction & task oriented exercise. The essence of the intervention is to reduce the degree of curvature of the angle in scoliosis sufferers. Comparison or comparison in this study is the provision of interventions other than using the klapp exercise method. As for the outcome in this study is to see the effectiveness of the klapp exercise method with other methods in reducing the degree of curvature of the angle in children with scoliosis.

The next step is to perform an appraisal technique, namely the checklist technique on the PEDro scale. The aim is to see the quality of articles or journals with Randomized Controlled Trials (RCT) study designs. By carrying out the checklist appraisal technique on the PEDro scale, the results can make it easier for researchers to quickly assess whether the articles used in the study have a high or low risk of bias, which of course can affect the results of the research to be carried out. The PEDro checklists carried out have

11 points including: 1. Eligibility criteria; 2. Random allocation (random allocation); 3. Concealed allocation; 4. Similarity to the baseline (baseline comparability); 5. The subject is blind (blind subject); 6. Blind therapist (blind therapist); 7. Blind assessors; 8. At least obtained measurement results >85% of research subjects (adequate follow-up); 9. Analysis for treatment (intention to treat analysis); 10. Statistical comparison between groups (between group comparison); 11. Point estimates and variability. If these points are listed in the article, the value is 1 and if it is not listed in the article the value is 0, the total score is 11. Table 1 below shows the approximate results of the 5 articles that have been selected using the PEDro scale checklist.

Furthermore, after an assessment using the PEDro scale, the results obtained that all articles have eligibility criteria. Three articles were allocated randomly to patients. Two articles made a concealed allocation to patients and three articles did not perform a concealed allocation to patients during the study. Three articles have baseline comparability criteria that serve as a comparison of outcome measures before and after the intervention. There is one article that does blind subject and blind therapist, while there are two articles that do blind assessors during the research. Furthermore, all articles in the study had primary outcomes > 85% that could be used for adequate follow-up and all of these articles were selected in the intention-to-treat analysis (Table 2).

In the five selected articles, all articles have comparisons between groups (between group comparison) and the last point, there are three articles that have point estimates and variability. Of all the selected articles, a total appraisal value was obtained for each article, where there was one article that got a score of 5 with a moderate level of bias, three articles that got a score of 7 with a moderate bias and there was one article that got a score of 8 with a low bias.

## 3.2 Discussion

### 3.2.1 Comparison of the Klapp Method with GPR

The age of the respondents in the study conducted by (Fernandes & Pin, 2020) was between 20–30 years with several selected respondents being divided into several groups and then comparing their effectiveness in each group. As in the research conducted by (Fernandes & Pin, 2020) the subjects were divided into 3 groups, namely the control group, klapp, and GPR. Treatment was given for 9 sessions with a duration of 50 min for 3 weeks and a postural evaluation was carried out at the beginning and end of the examination. The results showed that both methods were able to reduce scoliosis in the subject after treatment, however, the results were not seen significantly. In the control group the change was 6.7%, in the Klapp group the reduction was higher, namely 21%, while in the GPR group the reduction was 17.5%. The lack of subjects in a larger group in the study (Fernandes & Pin, 2020) so that the results obtained were less than optimal. Although the results are not statistically significant, both methods have been shown to reduce the Cobb angle. One of the factors that affect the effectiveness of the intervention with the successful klapp exercise method is because the form of exercise is easy to apply, can be done alone even in groups besides it is practical and does not require a fee. (Fernandes & Pin, 2020).

Table 1. PICO (Population, Intervention, Comparison, Outcome)

No	Tahun	Judul	Population	Intervention	Comparison	Outcome
1.	2010	<i>Quantitative Photogrammetric Analysis of Klapp Method for Treating Idiopathic Scoliosis</i>	16 patients, 3 men and 13 women, from the Physical Therapy clinic of Alira, Volcano University Hospital UNIFENAS with an average age, weight and height of 15±2.61 yr, 48.48±12.36kg and 1.58±0.09, respectively, were screened and randomly selected to have idiopathic scoliosis.	All subjects were given the Klapp method.	Differences in the effect of Klapp exercise on the treatment of torso asymmetry with pelvic asymmetry in head position, cervical lordosis or thoracic kyphosis.	The degree of curvature of the angle is measured using the Cobb angle. The Klapp method is an efficient therapeutic technique for treating torso asymmetry and increasing flexibility. But it is not efficient for modification of pelvic asymmetry in head position, cervical lordosis or thoracic kyphosis.
2.	2017	<i>Klapp Method Effect on Idiopathic Scoliosis in Adolescents: Blind Randomized Controlled Clinical Trial</i>	22 students were randomly divided into the intervention group (n=12) and the inactive control group (n=10). Ages between 10 and 15 years, who participated in a screening assessment to verify suspected scoliosis.	Exercises with the Klapp method performed 20 sessions, 3x a week for the intervention group, and not actively carried out for the control group	The sample was divided into 2 groups, namely the control group and the intervention group (Klapp's method). The control group did not perform any intervention and was considered as an inactive control.	- Back muscle strength was measured using a dynamometer, body asymmetry and angle of gibbosity were measured using biophotogrammetry. - Klapp method is effective for stabilizing gibbosity and increasing spinal extensor muscle strength
3.	2013	<i>Comparative Kinetic Therapy for the Idiopathic Scoliosis in Adolescents</i>	9 adolescent patients aged between 14 and 17 years with idiopathic scoliosis who were divided into three groups based on the kinetesis method followed.	3 patients using the Klapp-Correl method, 3 patients using the Schroth method and 3 patients using the Vojta method.	Exercise with kinetic method (Klapp and correl method) with conventional program (schroth method and vojta method)	-Height, weight and scoliosis curvature as measured by Cobb angle -The small number of patients in each group cannot draw conclusions about the statistical efficiency of the three treatment methods (Klapp-Correl, Schroth, Vojta).
4.	2019	<i>Perbandingan Pengaruh Self Correction dan Task Oriented Exercise dengan Klapp Exercise terhadap Derajat Skoliosis Siswa dengan Skoliosis Idiopatik Tipe C</i>	Students of SMP Negeri 36 Bekasi City. The research subjects taken were 22 samples that matched the inclusion criteria in the study and were divided into 2 groups.	Self-correction & Task Oriented Exercise. The intervention was carried out 10 times, repeated 3 times a week	Differences in the effect of Self-Correction & Task Oriented Exercise with Klapp Exercise on the degree of scoliosis of junior high school students with idiopathic scoliosis type C	-Measurement of the degree of matation of scoliosis using a scoliometer and plumb line test to detect type C scoliosis. - Test the difference in degrees of scoliosis before and after the intervention of Self-correction & Task Oriented Exercise and Klapp Exercise using the paired t-test obtained p value = 0.0001. The results of the test of the difference in the effect of the intervention given were carried out by an independent t-test, obtained a p value = 0.609 which resulted in the conclusion that both the administration of Self Correction & Task Oriented Exercise and Klapp Exercise could both reduce the degree of scoliosis. There is no significant difference.
5.	2020	<i>Comparative Analysis of Klapp and GPR Methods in the Treatment of Idiopathic Scoliosis in Adults</i>	6 women, aged between 20 and 30 years, with idiopathic scoliosis, who met the inclusion and exclusion criteria.	The Klapp and GPR methods were carried out in 9 sessions with a duration of 50 minutes for 3 weeks.	The sample was divided into 3 groups namely control group (who did not attend any treatment), klapp and RPG to compare the two therapeutic methods in the treatment of idiopathic scoliosis.	-The curvature of the angle is measured by the Cobb angle. -Klapp method and GPR both reduced the rate of scoliosis compared to the control group by 6.7%. While in the klapp method the reduction reached 21% and in the GPR method the reduction reached 17.5%. -Klapp's method is effective in increasing the extensor muscles of the spine and preventing the development of the angle of gibbosity.

**Table 2.** Tabel Ceklis PEDro

Judul	Eligibility criteria	Random Allocation	Concealed Comparability	Baseline Comparability	Blind Subjects	Blind Therapist	Blind Assessors	Adequate Follow up	Intention-treat Analysis	Between-Group Comparison	Point Estimates and Variability	Hasil
<i>Quantitative Photogrammetric Analysis of the Klapp Method for Treating Idiopathic Scoliosis</i>	✓	✗	✗	✓	✗	✗	✓	✓	✓	✓	✓	7/11
<i>Klapp Method Effect on Idiopathic Scoliosis in Adolescents: A Randomized Controlled Clinical Trial</i>	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	7/11
<i>Comparative Kinetic Methods used for the Therapy of Idiopathic Scoliosis in Adolescents</i>	✓	✗	✗	✗	✗	✓	✗	✓	✓	✓	✗	5/11
<i>Perbandingan Pengaruh Self Correction dan Task Oriented Exercise dengan Klapp Exercise terhadap Derajat skoliosis Siswa SMP dengan Skoliosis idiopatik Tipe C.</i>	✓	✓	✗	✓	✗	✗	✗	✓	✓	✓	✓	7/11
<i>Comparative Analysis of Klapp and GPR Methods in the Treatment of Idiopathic Scoliosis in Adults</i>	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✗	8/11

### 3.2.2 The Effectiveness of the Klapp Method in Idiopathic Scoliosis

This article written by (De et al., 2007) shows that giving exercise using the klapp method which is carried out for 20 sessions, for each session of 5 min, and is carried out 3 times a week has proven to be effective for stabilizing gibbosis and strengthening extensor muscles. However, it is not possible to change the asymmetry of the body. This can be proven where the results after giving klapp exercise in the intervention group and the control group there is a change in the angle of the SHA measurement where the value after giving klapp exercise is  $0.35 \pm 0.41$  while the value in the control group which does not have any intervention is greater, namely  $0.58 \pm 0.51$ . Similarly, the measurement of THA in the intervention group after klapp exercise.

of  $0.42 \pm 0.58$  while in the control group it is greater that is  $0.86 \pm 0.64$ . Then the measurement of the gibbosis angle in the intervention group after being given klapp exercise was  $0.47 \pm 7.90$  while in the control group the value was greater, namely  $5.71 \pm 5.15$ . A limitation in the study conducted by (De et al., 2007) was that X-ray examination was not performed to measure the Cobb angle. The examination is only seen from the photos so that the severity of the degree of scoliosis does not look significant.

### 3.2.3 The Effectiveness of the Klapp Method Using Biophotogrammetry in the Treatment of Idiopathic Scoliosis

Research that has been carried out (Iunes et al., 2010) wrote that the klapp method is an effective therapeutic technique to treat torso asymmetry and increase trunk flexibility, however, it is not effective to modify with hip asymmetry in the head position, cervical lordosis or thoracic kyphosis. It is proven that in this study (Iunes et al., 2010) analyzing the effectiveness of the klapp method at the AJ angle (acromioclavicular joint) before being treated with klapp exercise was 2.29 while after being given treatment with klapp exercise it was 1.27. Similarly, the SJ angle (sternoclavicular joint) from 2.60 to 1.66, then the difference in the tarsal angle decreased from 14.00 to 12.78. Then the right knee angle from 176.58 to 175.76, for the tibiotarsal angle from 131.06 to 128.60 and for HJA (hip joint angle) from 131.76 to 120.41. Changes in the magnitude of the angle were carried out by training for 20 sessions. Judging from the results of pre and post examinations, it showed significant changes, but for more significant results, whether the klapp method was proven to be more effective in reducing the level of spinal curvature, more sessions were needed in doing exercises (Iunes et al., 2010).

### 3.2.4 Effect of Self Correction and Task Oriented Exercise with Klapp Exercise

To the degree of idiopathic scoliosis.

Research conducted by (Kurniawati et al., 2019) subjects were given the intervention of self-correction & task oriented exercise and klapp exercise. To see the results of differences in degrees of scoliosis before and after the intervention of self-correction & task oriented exercise and klapp exercise using the paired t-test. The results obtained with a value ( $p = 0.0001$ ) which indicates this intervention is proven to reduce the degree of scoliosis. Meanwhile, to see the results of the difference in the effect of the intervention using the independent t-test. The results were obtained with a value ( $p = 6.999$ ) so that there was no significant difference between the two interventions. This



is because the two interventions have an equally strong effect on decreasing the degree of scoliosis curvature. Subjects were given the intervention 10 times with repetition 3 times a week. For dosing the klapp method, the exercise was carried out for 40 min with a duration of 5 min for each movement. Based on the results of the study (Kurniawati et al., 2019) concluded that the intervention can be applied in one way to reduce the degree of scoliosis, especially scoliosis in adolescents.

### **3.2.5 Comparison of the Effects of the Effectiveness of the Klapp and Cotel Methods, Method Schroth, Vojta Method**

According to research (Amaricăi, 2013) there is no statistical efficiency seen from the three therapeutic methods given, namely the klapp and cotel method, the schroth method, and the vojta method. This happens because the number of patients in each group is small, so it does not bring out a significant effectiveness. Group with klapp. Method and cotel do 3 training sessions weekly (about 1 h per session). The group with the schroth method also did 3 training sessions weekly but each session was 45–60 min. Unlike the case with the vojta method group, 3–4 sessions are needed every day with a duration of 15–20 min per session. Because the subject in the previous vojta method had done an exercise program so the results were not good.

Apart from the above research results, the research article conducted by Yang et al., (2014) also conducted research on scoliosis sufferers with a total of 24 subjects which were divided into 2 groups, namely the three-dimensional exercise group and the Klapp exercise group. Each group was given the same dose that is 3x a week and given for 5 weeks. The research conducted (Yang et al., 2014) aims to see the effectiveness between the three-dimensional exercise and the Klapp exercise by using the paired t-test to compare the results of pre and post changes in each group and using the independent t-test to compare the results. Results between groups. The results obtained from the change in the Cobb angle of each group before the three-dimensional exercise was  $5.83 \pm 1.53$  reduced to  $2.91 \pm 4.12$ . Meanwhile, in the Klapp exercise group, before the large angle exercise of  $6.00 \pm 2.86$ , there was a reduction of  $4.12 \pm 3.45$ . Then when given the exercise simultaneously, the results obtained in the three-dimensional group that there was a change of  $2.92 \pm 1.11^\circ$  which indicated that there was no statistically significant change as evidenced by the value ( $p > 0.05$ ). Compared to the Klapp exercise group, there was a change of  $1.88 \pm 0.68^\circ$  which was statistically significant as evidenced by the value ( $p < 0.05$ ). In addition to the research articles above, there are research articles conducted by (Sari & Tirtayasa, 2013) revealing that there is a difference in the average degree of scoliosis with exercise and posture correction proven to reduce the degree of scoliosis with the results of pre and post data, namely ( $p < 0.05$ ). The subjects used were 30 respondents and then divided into two intervention groups, 15 respondents were given swiss ball exercises and 15 respondents were given klapp exercises. Both exercises are given at a dose of 45 min, a frequency of 3x a week for 12 weeks.

## 4 Conclusion

Based on the results of a literature review study of five selected articles, exercise therapy using the klapp exercise method has proven to be effective in reducing the degree of curvature of the angle in scoliosis sufferers. However, the results of the comparison study of the effect of the klapp exercise method with other methods revealed that there were no significant results between before and after the exercise was given. This is influenced by the number of subjects and the dose of exercise to different research samples, as well as from each method that is given an equally effective effect on reducing the degree of curvature of the angle in scoliosis sufferers so that the results of the more effective effect of all methods are less significant. In this case the physiotherapist can help and accompany the patient during therapy and provide a longer therapeutic dose so that the results look more significant.

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