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A Review of the Treatment for Low Back Pain among Adolescent Athletes

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Abstract
Background Nowadays there is an increased prevalence of adolescent athletes suffer from LBP. Early effective treatment can improve athletes' performance and delay their careers. **Obiectives** To identify the effective treatment for adolescent athletes with LBP. **Methods** Electronic searching on database from inception to January 2024 was used to retrieve articles. The assessment for quality used McMaster Critical Review Form for Quantitative Studies. **Findings** Only 4 articles met the inclusion criteria. **Implications** This study provides different treatments form LBP in adolescent athletes. However, which type of treatment is more effective needs further research.

Keywords: Adolescent; Athlete; LBP; Treatment

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1.0 Introduction

As we all know, there are many studies on the epidemiology, pathogenesis, pathogenesis, clinical manifestations and treatment of LBP in adults, but there are few studies on LBP in adolescents (Guerra et al., 2023). Adolescent athletes frequently complain of LBP, and this frequency is rising. There was evidence that LBP in teenage athletes has 12-month incidence estimates of 36% and point prevalence estimates of 16% in a review of over 80 studies(Wall et al., 2022). The prevalence of LBP varies according to the kind of sports. According to a study on youth athletes, volleyball, handball, and basketball had greater rates of LBP prevalence (Yabe et al., 2021).

One of the main reasons people miss work and become disabled globally is due to LBP. (Shokri et al., 2023). As for athletes, LBP has a particularly negative effect on an athlete's athletic career, and athletes who have LBP early in their careers are more likely to experience the condition later in life. Although LBP eases up rapidly for certain athletes, it can also hinder training, termination of career and lifetime agony(Wilson et al., 2021).

Additionally, research on adults has demonstrated that transdisciplinary rehabilitation, spinal manipulative treatment (SMT), exercise, and cognitive-behavioural therapy can all be successful ways to treat LBP(Nicol et al., 2023). Because there is little research on treatment strategies for adolescents, adult research serves as the basis for guideline recommendations. However, It has been discovered that LBP in adolescents differs significantly from LBP in adults. Teenagers may experience distinct biopsychosocial

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characteristics than adults when it comes to the onset of LBP. Adolescence is a time of hormonal change and musculoskeletal system maturity, which is very different from that of adults (Becheva et al., 2023). Besides, Adolescents may respond differently to interventions than adults due to different educational and sociocultural backgrounds, differences in understanding, and differences in adherence to interventions(Leite et al., 2022). Therefore, it is not advisable to treat teenagers with LBP based solely on adult research(Selhorst & Selhorst, 2015).

Taken together, effective treatments may be unique to this population of adolescent athletes with LBP. We aimed to conduct a systematic review to provide a basis for effective treatment in this group.

2.0 Literature Review

Two categories comprise most LBP in adolescent athletes: non-specific LBP and spondylolysis or other bone stress injuries(Nakao et al., 2023). Isthmic spondylolysis is the most common cause of specific LBP among adolescent athletes, which has been shown to occur as frequently as 47% in this cohort(Selhorst et al., 2019). The requirement for relative rest from sports is the main distinction between the present treatment for non-specific LBP and spondylolysis(Park et al., 2023).

Teenagers are more likely to experience back discomfort due to several causes, such as the fast expansion of the spinal column throughout puberty, sports, and so on. Though sport-specific risk factors have only recently been established, many sporting activities have been suggested to potentially have a role in teenage back pain with various sports(Vij et al., 2022). Research indicates that back pain is common in 27% of college football players, 50% of artistic gymnasts, and 86% of rhythmic gymnasts(Purcell & Micheli, 2009). A closer examination of the weightlifting sport revealed that the sport has a higher incidence of back pain(Fares et al., 2020). In soccer, there were statistically significant increases in back discomfort associated with the playing surface, prior back injuries, prior groyne injuries, and playing goalie(Haag et al., 2016). There is a considerable correlation between adolescents' lower back pain and combat sports like boxing(Mueller et al., 2017). Besides, It has been demonstrated that longer periods spent playing a sport increase the likelihood of developing back discomfort. Sports camps and competitions that last all day are among the activities that increase the chance of developing back discomfort.

Since it has been demonstrated that children and adolescents with LBP also have this illness as adults, it is critical to prevent and treat LBP in these populations(Silva et al., 2023). Treatment is often provided using a biological approach, emphasising imaging, pharmaceuticals, spinal injections, passive therapies, and surgical interventions—approaches linked to high costs, a lack of proof of efficacy, and a possible increase in impairment(Hartvigsen et al., 2018). Therefore, conservative treatment is still the primary line of treatment for teenagers with LBP before undergoing surgery or other invasive procedures; most cases of this type of treatment just require supportive care(Peck et al., 2021). Conservative management involves activity modification, bracing, and exercise, cognitive-behavioral therapy, spinal manipulative therapy (SMT), and interdisciplinary rehabilitation.

About lumbar bracing, there is debate over the effect on clinical outcomes and concerns that the restriction may increase mobility at the lumbar spine-sacral junction, therefore it should only be used for patients who do not improve without bracing(Moley et al., 2018; Selhorst et al., 2020). Several previous studies have recommended the use of braces during early physical therapy, rather than long-term fixation. This reduces muscle atrophy and allows for a faster return to movement(Selhorst et al., 2020).

Cognitive functional treatment (CFT), a multidimensional classification system, is the foundation of O'Sullivan's proposed care strategy for long-term LBP. The primary elements of the cognitive component include educating patients about the mechanisms underlying their pain and disability vicious cycle, addressing their fears and negative beliefs about pain and the results of magnetic resonance imaging, and increasing their awareness of how their body and mind react to pain, movement, and perceived threats. The behaviorally oriented functional component includes strengthening and conditioning the normalized movement pattern, normalizing painful and provocative movement patterns gradually towards the patient's functional goals, and retraining body schema (awareness) through the use of visual feedback. Some studies indicate that compared to a control group that did not receive any treatment, the results showed a decrease in the point prevalence of LBP, pain intensity, and disability in the cognitive functional approach group(Perich et al., 2011).

Previous studies showed that around 50% of patients with nonspecific LBP may improve from physiotherapy(PT), In the adult population, PT reduces the number of visits, expenses, MRIs, epidurals, and drugs, as well as discomfort and improves disability ratings (Lin et al., 2011). Although the teenage population has not been widely studied, PT is helpful for the treatment of LBP if teenage patients do seek help(Zapata et al., 2015).

When incorporated into a comprehensive therapy programme, lumbar manipulation has been demonstrated to be an effective treatment for individuals with LBP. Thrust manipulations are advised by current clinical practice standards as a means of reducing pain and impairment. However, its effect on the treatment of adolescents with LBP needs further study(Vaughn et al., 2012). According to the report, in patients with persistent non-specific LBP, a perturbation-based functional exercise intervention can lessen the intensity of the pain(Arampatzis et al., 2017). Additionally, the intervention increased the neuromuscular regulation of spine stability during abrupt loading and the strength of the trunk muscles.

In general, conservative treatment yields great results. Within six months, over 90% of patients are expected to resume their sports activities, and the majority of them say that their discomfort has subsided(Selhorst et al., 2020). Outlining the high probability of returning to sports can help reduce exercise hesitancy and fear of re-injury(Selhorst et al., 2020).

3.0 Method

The PICO (population, intervention, comparison, and outcome measure) review criteria apply to this systematic review study. (Table 1)

Table 1: PICO table review criteria

Element	Description
P	Young athletes aged 12-18 with low back pain
I	Conservative treatment (Cognitive functional treatment/ Lumbar manipulation/ Exercise and so on)
C	No intervention or control group; any standard physiotherapy treatment of LBP or sham therapy
O	Have any outcome measure that measures pain, physical function, disability, QOL, and psychological

Electronic databases PubMed, and Science Direct were searched and study collected from database inception until January 2024. The main keywords used for the search in the databases followed the Boolean operator were: "Adolescent" OR "Teenager" OR "Juvenile" AND "Athletes" OR "Sportsman" AND "Cure" OR "Treat" OR "Remedy" OR "Therapy" OR "Treatment" AND "LBP" OR "Spondylosis" OR "Backache" OR "Back Pain" OR "Specific LBP" OR "Non-Specific LBP".

After a second look for duplicates, the retrieved items were removed. The outcome measure that characterizes pain, physical function, disability, quality of life, or psychological was then applied to the remainder, and they were evaluated and analyzed. Guidelines, letters, editorials, comments, government reports, conference proceedings, meeting abstracts, recommendations or consensus development statements, qualitative research, systematic reviews, and surgical procedures were among the items excluded from our analysis.

This study used the McMaster Critical Review Form for Quantitative Studies as an appraisal instrument which consists of 16 questions: study purpose, literature, study design, blinding, sample description, sample size, ethics and consent, the validity and reliability of outcome measures used, intervention description, statistical significance, statistical analysis, conclusion, clinical implication and study limitation. There were three options for the available answer: yes, no or not addressed. When the answer is yes, it is marked as 1, no as 0, and not addressed, as no. The total score of this form is 16 points and is classified into five categories which are 0-8= poor, 9-10= good, 13-14= very good, and 15-16= excellent. The PRISMA diagram flow for search techniques in Figure 1 illustrates how the extracted data were examined and reported using PRISMA principles.

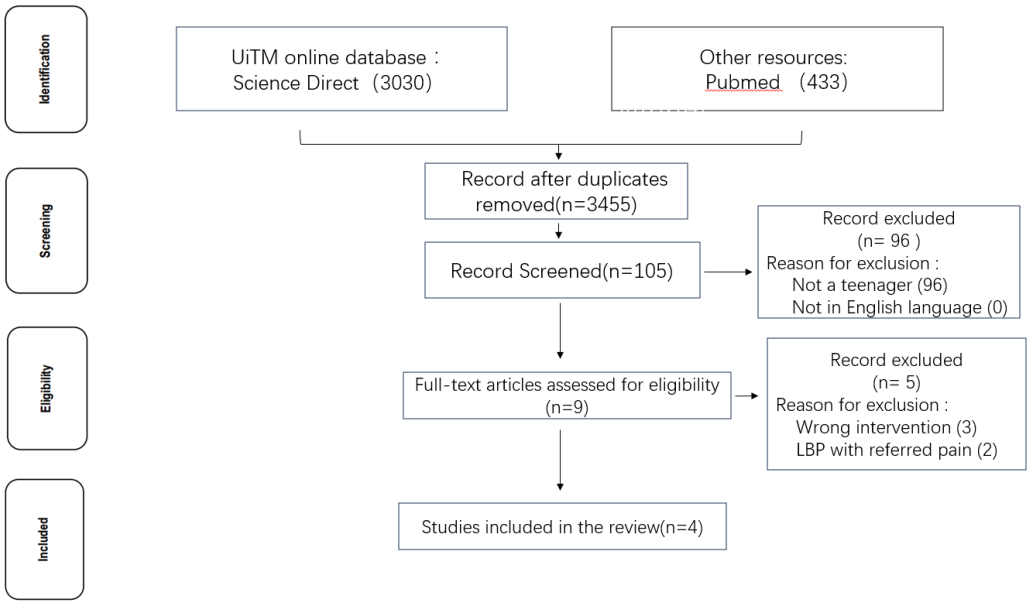

Figure 1: PRISMA diagram flow for search strategies

4.0 Findings

After the duplicate articles were eliminated, 105 RCTs were screened. There were 96 studies were excluded because their subjects were not teenagers. Then after full-text articles were evaluated, another 5 studies were excluded due to various reasons. Finally, only 4 studies met the inclusion criteria. The results of the data extraction are demonstrated in

Table 2: The results of the data extraction

Study	Type of Study	Number of participants and inclusion age	Method	Outcome measures	Result

(Ahlqwist et al., 2008)	RCT	●12-18 years old ●45 patients with low back pain were divided into two groups	●Forty-five people were included in the study, 23 in group 1:Individualized Physical Therapy and Exercise; 22 in group 2: Self Training According to Standardized Back Exercise ●Patients were treated two times per week for 12 weeks for Group 1; Patients were treated three times per week for 12 weeks for Group 2; assessing outcomes at baseline and 12 weeks.	●VAS ●Duration of Pain ●Quality of Pain ●Sit and Reach ●Trunk Muscle Endurance	Both groups improved statistically significant in most parameters over time. On comparison between the groups the physical function measured by Roland & Morris Disability Questionnaire and the duration of pain measured by Painometer improved statistically significant in Group 1.
(Ng et al., 2015)		●14-19 years old ●Thirty-six adolescent male rowers with LBP, who have between 1 and 4 years of school-level rowing experience	●Thirty-six adolescent male rowers were included in the study, 19 in Intervention group : Cognitive functional approach ; 17 in control group; ●Intervention group: The initial session was approximately 1 hour in duration and follow-up appointments were 30 min. Rowers were seen a week after the initial session and then fortnightly after that. control group: they remained free to seek treatment from healthcare providers external to the project ●assessing outcomes at Baseline/ 8 weeks and 12 weeks.	●Specific Functional Scale ●Roland Morris Disability Questionnaire ●Muscle endurance tests ●Ergometer kinematics	Compared with the control group, the intervention group reported significantly less pain during ergometer rowing (Numeric Pain Rating Scale −2.4, p=0.008) and reduced disability (Patient Specific Functional Scale (4.1, p=0.01); Roland Morris Disability Questionnaire (−1.7, p=0.003)) following the intervention, and at 12 weeks follow-up. They also demonstrated greater lower limb muscle endurance (20.9 s, p=0.03) and postured their lower lumbar spine in greater extension during static sitting (−9.6°, p=0.007). No significant differences were reported in back muscle endurance and regional lumbar kinematics during ergometer rowing.
(Selhorst & Selhorst, 2015)	RCT	● 13–17 years old, ●Thirty-four adolescent with mechanical LBP	●Thirty-four patients with acute LBP were included in the study, 17 in Intervention group : Manipulation group; 17 in control group: Sham Manipulation group ●The total number of treatment sessions prescribed was eight visits for both groups. ●assessing outcomes at Baseline/ 4 weeks and 6 months.	● Pain ●Patient-specific functional scale (PSFS) ●Global rating of change (GROC) scores	Both groups experienced significant improvement over time in all measures. There were no differences between groups for pain, PSFS, or GROC scores. No increased risk of adverse reaction from lumbar manipulation was noted.
(Arampatzis et al., 2021)	RCT	● 13–18 years old, ●Thirty-seven adolescent athletes	●Thirty-seven adolescent athletes were included in the study, ●In a 2-year prospective research design, In the first year (control), the athletes performed their usual training program, while in the second year (intervention), a perturbation-based trunk exercise intervention was implemented (two times per	●Low-back pain incidence, ●Trunk muscle strength, ●Lumbo-pelvic Alignment ●Kinematics	The 3 months prevalence of low-back pain reduced by 49% in the intervention compared to the control year. Further, low-back pain intensity decreased (P = .019, d = 0.524) and muscle strength of the trunk extensors (P = .040, d = 0.585) and trunk flexors (P = .002, d = 0.515) increased in the intervention year. Finally, a reduction (P < .001,

	week for 25 minutes). ●assessing outcomes measured four times per year	d = 1.401) of strength imbalances between the flexor and extensor muscles was observed. Lumbo-pelvic alignment and kinematics during forward bending did not alter (P > .05) due to the intervention.

These three studies (Arampatzis et al., 2021) show that physiotherapy treatment, cognitive functional approach, perturbation-based exercise intervention can improve pain, physical function and disability in adolescents with low back pain. The study (Selhorst & Selhorst, 2015) found that adding lumbar manipulation to an exercise regimen for adolescents with acute low back pain did not significantly improve outcomes. Meanwhile, lumbar manipulation of teenagers did not appear to raise the probability of an adverse reaction. All four studies scored excellent (15-16/16) on the McMaster Critical Review Form for Quantitative Studies. Table 3 shows the effect of four different treatment modalities on pain, physical function, and disability of LBP in adolescent athletes.

Table 3: The effects of different therapy on pain intensity, physical function, disability

Study	Effects		
	Improve pain intensity	Improve physical function	Improve disability
(Ahlqwist et al., 2008)	√	√	√
(Ng et al., 2015)	√	√	√
(Arampatzis et al., 2021)		√	
(Selhorst & Selhorst, 2015)	Uncertain	Uncertain	Uncertain

5.0 Discussion

From this study (Ahlqwist et al., 2008), we found that active treatment can improve the impact of back disorders in children and adolescents over time. Following the therapy period, the kids in both groups evaluated their physical, psychological, and pain management as being on par with kids in other healthy groups (Fatoye et al., 2020). The better results in functional ability with Physical Therapy Treatment may be related to the fact that children are more functionally trained because they meet regularly with a physical therapist and are not afraid to move during exercise, even if they sometimes get hurt or feel stressed. An episode of back discomfort in a very active youngster should be followed by individualized rehabilitation consisting of exercises to improve trunk stability, neuromuscular control, technique, mobility, balance, and coordination, depending on the specific activity. Children could profit in the long run from such programmes by being protected from harm. For lower back pain, while home remedies can be helpful, some children can't take responsibility for a home exercise program or are so affected by the pain that they can't start on their own. These children still need specialized physical therapy.

Ng et al., (2015) was the first RCT to evaluate the effectiveness of an intervention in rowers with low back pain. When compared to the control group, rowers who received the cognitive functional approach experienced less severe pain and reduced degrees of impairment when using the ergometer and showed increased lower limb muscle endurance and greater lower lumbar extension during regular sitting. After the intervention, the sensitivity of the intervention group to pain during rowing was significantly reduced compared to the control group, which may be due to increased load-bearing capacity and/or reduced sensitivity of the spinal structure to buckling load after the intervention.

In teenagers with LBP, exercise has been demonstrated to reduce pain and impairment. In this study (Selhorst & Selhorst, 2015), it was found that adding lumbar manipulation to the exercise regimen for adolescents with acute low back pain did not have any additional benefit. Based on the experience of experts, for some teenagers with LBP, lumbar manipulation has helped to reduce pain and promote motion within the session. This may be due to the different effects of lumbar manipulation on different types of LBP (de Zoete et al., 2021). What's worse, this research found that at the 6-month follow-up, 65% of patients in both groups either still had LBP or experienced a return of symptoms. The study's findings are in line with other research, which found that teenagers continued to experience back pain and that most patients' symptoms did not go away after six months, even with recommended rehabilitation(Ahlqwist et al., 2008). Therefore, more effective rehabilitation treatment measures are needed to prevent such things from happening.

In this study(Arampatzis et al., 2021), adolescent athletes who underwent a year of the suggested perturbation-based exercise intervention of the trunk muscles saw improvements in trunk muscle strength as well as a reduction in strength imbalances between the flexor and extensor muscles. More importantly, both the prevalence and degree of low-back discomfort were markedly decreased by the intervention. The goal of perturbation-based exercise was to create a functional perturbation training programme for the trunk muscles by continuously applying different, somewhat unanticipated perturbations. Adolescent athletes would then include these exercises into their regular training regimens. Lower back pain and injury risk are reduced through increased trunk muscle strength and improved neuromuscular control of spinal stability. According to reports, when in motion, the neuromotor system is challenged and movement instability is increased by external perturbations(Munoz-Martel et al., 2019). Proprioceptive input plays a major role in the specific regulation of motor control and neural network reorganisation that occurs after being exposed to disturbances. Therefore, perturbation-based interventions are effective and attractive in the prevention and treatment of LBP.

A common weakness of these studies is that the same therapists examined and treated the children, so the therapists may have paid more attention to the study group, skewing the results; Most of the indicators detected are scales and lack objective indicators. There are few studies on LBP in adolescent athletes, and the sample size is also small, so the experimental results are not convincing.

5.1 Implication of the Study

This study provides healthcare providers, especially physical therapists, with different treatments for LBP in adolescent athletes, which provides a basis for early treatment, pain reduction, avoidance of disability, and return to sports for adolescent athletes with LBP. However, which type of treatment is more effective needs further research.

6.0 Conclusion& Recommendations

This study involves a variety of treatment methods for low back pain in young athletes, such as exercise, physical therapy, cognitive function methods, etc., which can also reduce pain and prevent disability. However, it involves different influencing factors for different athletes, the sample size is too small, and the evaluation criteria of the study are not uniform, so no clear conclusion can be drawn. Therefore, it is necessary to increase the study of different types of athletes with low back pain with large samples to find more effective and convincing treatment measures.

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Paper Contribution to Related Field of Study

Exercise, Physiotherapy, Cognitive functional approach

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