

Effects of spinal manipulation on lower limb strength and endurance in adolescent athletes: a randomized controlled trial

Submission date 25/07/2025	Recruitment status No longer recruiting	☒ Prospectively registered ☒ Protocol
Registration date 28/07/2025	Overall study status Completed	☐ Statistical analysis plan ☐ Results
Last Edited 26/03/2026	Condition category Musculoskeletal Diseases	☐ Individual participant data ☒ Record updated in last year

Plain English summary of protocol

Background and study aims

This study is looking at whether a chiropractic technique called spinal manipulation can help teenage athletes get stronger and perform better. Many young athletes have small joint or muscle issues that might affect how well they move or increase their risk of injury. The researchers want to see if spinal manipulation can support strength development during a short training program.

Who can participate?

Healthy teenage athletes aged 15 to 17 years can take part, as long as they've been cleared by a doctor for physical activity and haven't had spinal manipulation before.

What does the study involve?

Participants will be randomly placed into one of two groups. Both groups will do the same four-week strength training program. One group will also receive spinal manipulation once a week. Before and after the program, everyone will do tests to measure leg strength, balance, and how confident and tired they feel during exercise.

What are the possible benefits and risks of participating?

Taking part might help improve strength, balance, and body awareness. The risks are very low and similar to those of regular exercise. Spinal manipulation is commonly used and is considered safe for healthy teens when done by trained professionals.

Where is the study run from?

Caozhou Wu School in Heze, Shandong Province, China.

When is the study starting and how long is it expected to run for?

June 2025 to August 2025.

Who is funding the study?

Investigator initiated and funded

Who is the main contact?
Qian Zhang, lemon28@icloud.com

Contact information

Type(s)

Scientific, Principal investigator

Contact name

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Additional identifiers

Study information

Scientific Title

A randomized controlled trial evaluating the effects of spinal manipulation on lower extremity strength and functional performance in adolescent athletes

Study objectives

To evaluate the effects of spinal manipulation on lower extremity strength and functional performance in adolescent athletes. The study aims to determine whether spinal manipulation can enhance lower-limb power, endurance, and agility when compared to a control group undergoing physical training alone.

Ethics approval required

Ethics approval required

Ethics approval(s)

Approved 11/07/2025, Sports Science Experiment Ethics Committee of Beijing Sport University (No. 48, Information Road, Haidian District, Beijing, 100084, China; +86 10-62989306; bsulb@bsu.edu.cn), ref: 2025325H

Primary study design

Interventional

Study design

Prospective randomized controlled trial with two parallel groups

Study type(s)

Prevention, Quality of life, Treatment

Health condition(s) or problem(s) studied

Musculoskeletal performance deficits, including suboptimal lower-limb strength and endurance, in adolescent athletes

Interventions

The experimental group received lumbopelvic spinal manipulation (SM) once a week for four weeks, targeting segmental dysfunction identified through motion palpation. The control group continued routine physical training without manual intervention. All participants underwent pre- and post-assessment of lower-limb strength, power, and endurance.

Participants were randomly assigned to the experimental or control group using a computerized random number generator created in Microsoft Excel. The RAND() function was used to generate a random number for each participant, which was then sorted to determine group allocation. An independent researcher—who was not involved in participant recruitment, intervention, or data analysis—managed the sequence and prepared sealed, opaque envelopes to conceal allocation. This process ensured both randomisation integrity and allocation concealment.

Intervention Type

Other

Primary outcome(s)

Lower-limb strength measured using 40kg squat repetitions to fatigue and 1RM squat test (kg) at baseline and after 4 weeks (post-intervention)

Key secondary outcome(s)

1. Agility measured using the two-point agility test (s) at baseline and post-intervention (week 4)
2. Static balance measured using single-leg balance test (s) at baseline and post-intervention (week 4)
3. Perceived exertion and confidence measured using Session RPE and SRQ immediately after each training session

Completion date

28/08/2025

Eligibility

Key inclusion criteria

1. Medically cleared for physical activity
2. Participating in a structured physical training program
3. No musculoskeletal injuries within the past 3 months
4. No prior exposure to spinal manipulation
5. Provided signed informed consent (by participant and legal guardian)

Participant type(s)

Healthy volunteer, Learner/student

Healthy volunteers allowed

No

Age group

Child

Lower age limit

15 Years

Upper age limit

17 Years

Sex

All

Total final enrolment

90

Key exclusion criteria

1. Acute or chronic musculoskeletal injuries
2. Neurological or cardiovascular conditions affecting exercise performance
3. Current use of medications affecting neuromuscular function
4. History of spinal surgery
5. Refusal or inability to provide informed consent

Date of first enrolment

02/08/2025

Date of final enrolment

05/08/2025

Locations

Countries of recruitment

China

Study participating centre
CAO ZHOU WU School
Mu Dan South Rd No.855
HeZe
China
274000

Sponsor information

Organisation
Beijing Sport University

ROR
<https://ror.org/03w0k0x36>

Funder(s)

Funder type
Other

Funder Name
Investigator initiated and funded

Results and Publications

Individual participant data (IPD) sharing plan

The datasets generated during the current study will be available upon reasonable request from the lead researcher, Dr. Qian Zhang (qian.zhang@palmer.edu). The data shared will include de-identified individual performance scores and questionnaire results. Data will be available from December 2025 for up to 5 years. Access will be granted to academic researchers for non-commercial use, subject to ethical approval and data-sharing agreement. Data will be anonymised prior to release to ensure participant confidentiality.

IPD sharing plan summary

Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet			28/07/2025	No	Yes
Protocol file			28/07/2025	No	No