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Can a protein-mineral drink support bone and muscle health in young basketball players?

Submission date
15/05/2026

Recruitment status
No longer recruiting

Registration date
18/05/2026

Overall study status
Completed

Last Edited
15/05/2026

Condition category
Musculoskeletal Diseases

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[ ] Results
[ ] Individual participant data
[X] Record updated in last year

Plain English summary of protocol
Background and study aims
Young basketball players often take part in regular high-intensity training during a period when their bones and muscles are still developing. Good nutrition may help support bone health, muscle function and recovery during this important stage of growth. This study aims to find out whether a daily protein-mineral nutritional supplement can improve markers of bone health and muscle function in adolescent basketball players.

Who can participate?
Adolescent basketball players aged 14 to 18 years who have received systematic basketball training for at least 3 years and currently train for at least 15 hours per week may participate. Participants must be in good general health, able to complete the study tests and have written consent from both themselves and their legal guardians.

What does the study involve?
Participants are randomly assigned to one of two groups. One group receives a daily protein-mineral nutritional supplement for 16 weeks. The other group receives a placebo drink that looks and tastes the same but does not contain the active nutritional ingredients. Neither the participants nor the researchers know which group each participant is in until the study is completed. Blood tests, bone assessments, muscle strength tests and performance tests are carried out to compare changes between the two groups.

What are the possible benefits and risks of participating?
Participants may benefit from closer monitoring of their bone health, muscle function and training-related health indicators. The nutritional supplement may help support musculoskeletal health, although this cannot be guaranteed. Possible risks include mild gastrointestinal discomfort, such as bloating, nausea or diarrhoea. Blood sampling may cause temporary discomfort, bruising or light-headedness. Safety indicators are monitored throughout the study.

Where is the study run from?
Chizhou University (China)

When is the study starting and how long is it expected to run for?
September 2024 to May 2025

Who is funding the study?
Chizhou University (China)

Who is the main contact?
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Public, Scientific

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Study information

Scientific Title
Effects of a 16-week multi-component protein-mineral supplement on bone turnover and muscle function in adolescent basketball players: a randomized double-blind placebo-controlled trial

Study objectives
The primary objective of this study is to evaluate the effect of a 16-week multi-component protein-mineral nutritional supplement on bone turnover in adolescent basketball players undergoing high-intensity training.

Secondary objectives are to assess changes in bone microstructure, bone mineral density, muscle strength, functional performance, and safety/tolerability. Exploratory objectives are to investigate potential muscle-bone adaptive responses, including changes in myokines, osteokines, and related regulatory biomarkers.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 01/08/2024, Research Ethics Committee of Chizhou University (No. 199, Muzhilu Road, Guichi District, Chizhou, 247200, China; +82 (0)5662748827; czxyjy@czu.edu.cn), ref: CZ20240801

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking

Blinded (masking used)

Control
Placebo

Assignment
Crossover

Purpose
Treatment

Study type(s)

Health condition(s) or problem(s) studied
Bone metabolic stress, suboptimal musculoskeletal adaptation, and muscle function changes associated with high-intensity training in adolescent basketball players

Interventions
Eligible participants are randomly assigned in a 1:1 ratio to either the intervention group or the placebo group. The randomisation sequence is generated by an independent statistician using a computer-generated random number table. Block randomisation with a block size of 4 is used, stratified by sex and age group, namely 14–16 years and 17–18 years. Allocation is implemented using sealed, opaque, sequentially numbered envelopes.

Participants in the intervention group receive a daily multi-component protein-mineral nutritional supplement for 16 weeks. Each serving contains 28 g of protein, including whey protein and collagen protein, combined with calcium, phosphorus, magnesium, vitamin D3, vitamin K2, lactoferrin and casein phosphopeptides. The supplement is taken within 30 minutes after training or after breakfast on non-training days.

Participants in the placebo group receive an isocaloric maltodextrin placebo for 16 weeks. The placebo has an identical appearance, taste and packaging to the intervention product.

Intervention Type
Supplement

Primary outcome(s)
1. Serum procollagen type I N-terminal propeptide (P1NP) concentration measured using an electrochemiluminescence immunoassay from fasting morning blood sample at baseline and week 16. The primary endpoint is the change in serum P1NP concentration from baseline to week 16.

Key secondary outcome(s)
1. Serum C-terminal telopeptide of type I collagen concentration (CTX-1) measured from fasting morning blood samples using a validated laboratory immunoassay at baseline and week 16.
2. Serum bone-specific alkaline phosphatase concentration (BALP) measured from fasting morning blood samples using a validated laboratory assay at baseline and week 16.
3. The P1NP/CTX-1 ratio is calculated from serum P1NP and CTX-1 values at baseline and week 16.
4. Bone mineral density is measured using dual-energy X-ray absorptiometry (DXA) at baseline and week 16.

5. Bone microstructure is measured using high-resolution peripheral quantitative computed tomography (HR-pQCT) at baseline and week 16. Parameters include trabecular bone volume fraction, trabecular thickness, trabecular number, cortical thickness, cortical bone mineral density, estimated stiffness and estimated failure load.
6. Knee extensor muscle strength is measured using isokinetic dynamometry with the Biodex system at baseline and week 16.
7. Functional performance is measured using vertical jump height and 20-metre sprint time at baseline and week 16.
8. Muscle-bone adaptation biomarkers, including myostatin, irisin, insulin-like growth factor-1, undercarboxylated osteocalcin and fibroblast growth factor-23, are measured from fasting blood samples using validated laboratory assays at baseline and week 16.
9. Safety and tolerability are assessed using adverse event records, gastrointestinal symptom scores, liver function tests, kidney function tests, serum calcium and urinary calcium/creatinine ratio during the intervention period, including baseline, weeks 4, 8, 12 and 16, and the week 20 follow-up assessment.

Completion date
15/05/2025

Eligibility

Key inclusion criteria
1. Aged 14–18 years
2. Male or female adolescent basketball players
3. Systematic basketball training for ≥3 years
4. Current training volume ≥15 hours/week
5. Bone age within 1 year of chronological age
6. Good general health and able to complete all study assessments
7. Written informed consent from both participant and legal guardian

Healthy volunteers allowed
Yes

Age group
Mixed

Lower age limit
14 Years

Upper age limit
18 Years

Sex
All

Total final enrolment
100

Key exclusion criteria

1. History of metabolic bone disease
2. Fracture within the past 6 months
3. Endocrine disorders affecting bone metabolism
4. Use of medications affecting bone metabolism within the past 3 months
5. Severe gastrointestinal disease
6. Allergy to study product ingredients
7. Participation in another clinical trial during the study period

Date of first enrolment
15/09/2024

Date of final enrolment
15/12/2024

Locations

Countries of recruitment
China

Sponsor information

Organisation
Chizhou University

ROR
https://ror.org/007cx7r28

Funder(s)

Funder type

Funder Name
Chizhou University

Alternative Name(s)
, CZU

Funding Body Type
Private sector organisation

Funding Body Subtype
Universities (academic only)

Location

China

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available