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**Effects of Long-Term Exercise Training on Serum Uric Acid Levels in Adults: A Systematic Review and Exploratory Meta-Analysis**

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**ADMINISTRATIVE INFORMATION**

**Support** - The project on collaborative management of chronic diseases integrating traditional Chinese and Western medicine, project number: CXZH2024141.

**Review Stage at time of this submission** - Data extraction.

**Conflicts of interest** - None declared.

**INPLASY registration number:** INPLASY202670105

**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 27 July 2026 and was last updated on 27 July 2026.

**INTRODUCTION**

**Review question / Objective** To summarize the available evidence on the effects of long-term exercise training on serum uric acid levels in adults, and to explore whether effects differ by exercise modality.

**Condition being studied** This review focuses on serum uric acid levels in adults. Uric acid is a key biomarker of purine metabolism, and elevated uric acid is associated with hyperuricemia, gout, obesity, insulin resistance, metabolic syndrome, hypertension, chronic kidney disease, and cardiovascular risk. Exercise training is widely recommended as a non-pharmacological lifestyle strategy to improve metabolic health, but its effect on uric acid levels remains unclear. This review will evaluate the effects of long-term exercise training on serum uric acid levels in adults.

**METHODS**

**Participant or population** The study participants were adults aged 18 years or older, including healthy adults and individuals with metabolic or cardiometabolic conditions, such as obesity, hypertension, hyperuricemia, type 2 diabetes, metabolic syndrome, or cardiovascular-related diseases.

**Intervention** The intervention was long-term exercise training as the main intervention component, including aerobic exercise, resistance training, or combined exercise training.

**Comparator** The comparator was a non-exercise control condition, such as usual lifestyle, usual care, health education, sedentary control, or no special intervention.

**Study designs to be included** The study design was a randomized controlled trial, or observational cohort study.

**Eligibility criteria** Studies were excluded if they met any of the following criteria:

(1) the study was conducted in children, adolescents, animals, or in vitro models; (2) the study focused exclusively on patients receiving dialysis, including hemodialysis or peritoneal dialysis; (3) the intervention was acute exercise, single-session exercise, exercise testing, or short-term exercise exposure rather than long-term exercise training; (4) the study had no non-exercise control group, such as single-arm self-controlled before-after studies or studies comparing only different exercise modalities without a non-exercise control group; (5) the intervention was mainly pharmacological, dietary, fasting-based, supplementation-based, or traditional medicine-based, and the independent effect of exercise could not be separated; (6) the study did not report serum or plasma uric acid levels or did not provide extractable numerical outcome data; (7) the study reported only urinary uric acid, salivary uric acid, uric acid clearance, fractional excretion of uric acid, or purine metabolites without serum or plasma uric acid values; (8) the article was a review, meta-analysis, editorial, commentary, case report, conference abstract, study protocol, or duplicate publication; or (9) the full text could not be obtained.

**Information sources** PubMed, Embase, Web of Science.

**Main outcome(s)** The main outcome is the change in serum uric acid level after long-term exercise training compared with a non-exercise control condition.

**Quality assessment / Risk of bias analysis** The risk of bias of randomized controlled trials was assessed using the Cochrane Risk of Bias 2 tool. Non-randomized controlled studies will be assessed using the MINORS scale. Two reviewers will independently perform the assessment, and disagreements will be resolved by discussion or consultation with a third reviewer.

**Strategy of data synthesis** Serum or plasma uric acid will be analyzed as a continuous outcome. The primary effect size will be the mean difference (MD) with 95% confidence interval (CI), comparing the change in uric acid levels from baseline to the end of intervention between exercise and non-exercise control groups. All uric acid values will be standardized to  $\mu\text{mol/L}$ , and values reported in  $\text{mg/dL}$  will be converted using  $1 \text{ mg/dL} = 59.48 \mu\text{mol/L}$ . Change-from-baseline data will be preferred. When change standard deviations are unavailable, they will be estimated from baseline and post-

intervention standard deviations using an assumed within-person correlation coefficient. Heterogeneity will be assessed using Cochran's Q test and the  $I^2$  statistic. A fixed-effect model will be used when heterogeneity is low, whereas a random-effects model will be used when substantial heterogeneity is present.

**Subgroup analysis** Subgroup analyses will be conducted according to exercise modality, including aerobic exercise, resistance training, and combined exercise, where data are available.

**Sensitivity analysis** Sensitivity analyses will be performed by excluding one study at a time.

**Language restriction** English.

**Country(ies) involved** China.

**Keywords** Exercise training; Uric acid; Systematic review; Meta-analysis.

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