

# Study Protocol

**Title:**

Effects of Taurine Supplementation on Repetitive Sprint Performance and Exhaustion Time in College Students Under High-Temperature and High-Humidity Conditions

**Protocol ID:**

No. 2021A43

**Date:**

January 9, 2025

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## 1. Background

High-temperature and high-humidity environments (defined as ambient temperature  $\geq 35^{\circ}\text{C}$  and relative humidity  $\geq 60\%$ ) adversely affect sports performance by increasing the body's heat load and impairing thermoregulation. These conditions lead to earlier fatigue, reduced performance, and increased physiological strain. Recovery after exhaustion is critical in such conditions for enhancing subsequent performance.

Taurine, a sulfur-containing amino acid, has shown promise in enhancing sports performance, improving calcium regulation in muscles, reducing oxidative stress, and mitigating fatigue under extreme environmental conditions. Previous studies have highlighted taurine's benefits, but the effects of different taurine doses in repetitive sprint (RS) exercises after exhaustive exercise in high-temperature and high-humidity conditions remain unclear. This study aims to investigate these effects in college students.

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## 2. Objectives

**Primary Objective:**

To examine the effects of acute pre-exercise taurine supplementation at different doses (6g, 4g, 1g) on RS performance and endurance following exhaustive exercise in high-temperature and high-humidity environments.

**Secondary Objectives:**

- To analyze the impact of taurine on physiological indicators, such as heart rate (HR) and blood lactate (BLA).
  - To measure subjective sensations using the rating of perceived exertion (RPE).
  - To evaluate recovery performance through reverse vertical jump height.
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### 3. Study Design

#### Design:

- Single-blind, randomized, crossover-controlled experimental design.
- Four groups: High-dose taurine (6g), Medium-dose taurine (4g), Low-dose taurine (1g), Placebo (0g).
- Each subject participated in four trials, one for each group.

#### Environment:

- Temperature maintained at  $32\pm1^{\circ}\text{C}$  and relative humidity  $\geq 60\%$ , using a heating system (SAWO, Finland) and humidification system (BELIN, China).

#### Participants:

- 16 college students (8 male, 8 female) from Capital University of Physical Education and Sports.
- Inclusion Criteria:
  1. Aged 18–28 years.
  2. No exercise-related risk as indicated by the PAR-Q questionnaire.
  3. No taurine-based supplementation in the past month.

#### Experimental Process:

- Pre-exercise taurine/placebo ingestion (6g, 4g, 1g, or placebo).
  - RS test (6 sprints, 10 seconds each, with 10-second recovery intervals).
  - Measurements: Peak Power (PP), Mean Power (MP), Fatigue Index (FI), HR, BLA, RPE, and exhaustion time (ET).
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### 4. Experimental Procedure

#### 1. Warm-Up:

- 5-minute steady-state cycling at 100W.
- Measurement of reverse vertical jump height.

#### 2. Exhaustive Exercise Test:

- Cycling test to exhaustion, starting at 50W and increasing by 50W every 3 minutes at 60 RPM.
  - Exhaustion determined by cadence drop or inability to maintain resistance.
  - 3. **Rest and Recovery:**
    - 20-minute recovery period with periodic measurements of HR, RPE, and BLA.
  - 4. **Repetitive Sprint Test (RS):**
    - Six maximal sprints (10 seconds each) with resistance set at 7.5% of body weight.
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## 5. Measurements

- **Sports Performance Indicators:** PP, MP, FI (recorded for each sprint).
  - **Endurance and Recovery Indicators:** ET, reverse vertical jump height.
  - **Physiological Indicators:** HR and BLA (monitored pre-, post-exercise, and during recovery).
  - **Subjective Indicators:** RPE assessed at pre-defined intervals.
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## 6. Statistical Analysis

- Data analyzed using SPSS 27.0.
  - Normality tested using the Shapiro-Wilk test.
  - Repeated measures ANOVA (group  $\times$  time) for performance indicators.
  - Paired-samples t-tests for pre- and post-test comparisons.
  - Significance level set at  $P < 0.05$ .
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## 7. Ethical Considerations

- Study approved by the Institutional Ethical Committee of Capital University of Physical Education and Sports, Beijing, China (No. 2021A43).
- Informed consent obtained from all participants.

# Statistical Analysis Plan

**Title:**

Statistical Analysis Plan for the Effects of Taurine Supplementation on RS Performance in High-Temperature and High-Humidity Environments

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## 1. Objectives

- Analyze the effects of different taurine doses on RS performance metrics (PP, MP, FI).
- Assess endurance and recovery indicators (ET, reverse vertical jump height).
- Investigate physiological responses (HR, BLA) and subjective fatigue (RPE).

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## 2. Statistical Software

- SPSS Version 27.0.

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## 3. Data Analysis Methods

- Descriptive Statistics:**
  - Means  $\pm$  standard deviations calculated for all variables.
- Normality Test:**
  - Shapiro-Wilk test to check for normal distribution.
- Primary Analysis:**
  - Repeated measures ANOVA for group  $\times$  time interaction effects on PP, MP, FI, HR, BLA, and RPE.
- Secondary Analysis:**
  - Paired-samples t-tests for reverse vertical jump pre- and post-exercise comparisons.

- One-way ANOVA for ET across groups.
- 5. Effect Sizes:**
- Partial eta-squared ( $\eta^2_{\text{partial}}$ ): 0.01 (small), 0.06 (medium), 0.14 (large).
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#### **4. Data Presentation**

- Line graphs for repeated measures (PP, MP, FI, HR, BLA, RPE).
  - Bar charts for pre- and post-test comparisons (reverse vertical jump).
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#### **5. Significance Criteria**

- Statistical significance set at  $P < 0.05$ .