

Can creatine supplements and strength training help firefighters perform better and stay safer on the job?

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Registration date 03/09/2026	Overall study status Completed	☐ Statistical analysis plan ☐ Results
Last Edited 03/09/2026	Condition category Other	☐ Individual participant data ☒ Record updated in last year

Plain English summary of protocol

Background and study aims

Firefighting is one of the most physically demanding occupations, and cardiovascular disease is responsible for nearly half of all on-duty firefighter deaths. Firefighters must complete strenuous, unpredictable tasks — often in extreme heat, while wearing heavy protective gear and breathing apparatus — which places enormous strain on the heart, muscles, and mind.

Creatine monohydrate is a popular nutritional supplement known to improve strength, muscle endurance, and recovery in athletes. This study aims to find out whether creatine, combined with a structured strength training program, can help firefighters perform better on the physically and mentally demanding tasks required of their job — including simulated fireground rescue tasks, strength tests, and mental sharpness tests — and whether it may help lower long-term cardiovascular strain associated with the job.

Who can participate?

Career firefighters (male and female) between the ages of 18 and 50, currently employed by the Lake Travis Fire Department or Fort Worth Fire Department, are eligible to participate. Participants must be in general good health and able to provide informed consent.

What does the study involve?

Participant firefighters will be randomly assigned to one of two groups: one group will take a creatine supplement, and the other will take a placebo (an inactive substance that looks and tastes the same). Neither the participants nor the research team will know who is in which group until the study is finished.

Both groups will follow the same 12-week strength and conditioning program, held at their fire station while on shift. The creatine group will take a higher "loading" dose for the first week, then a lower daily "maintenance" dose for the remaining 11 weeks. The placebo group will follow an identical schedule with an inactive substance.

All participants will complete testing at three points: before starting supplementation, after one week, and after twelve weeks. Testing includes:

1. A simulated firefighting task course, completed in full gear, that mirrors the physical demands of a real emergency response
2. Strength and fitness tests (including a treadmill-based cardio test, weightlifting tests, and a jump test)
3. Blood tests to monitor safety
4. Simple computer-based tests of memory, reaction time, and mental focus
5. Questionnaires about mood, stress, and anxiety

What are the possible benefits and risks of participating?

Participants may benefit from improved strength, endurance, and job-related physical performance through the structured training program, regardless of which supplement group they are in. Creatine monohydrate is widely studied and generally considered safe for healthy adults when taken as directed.

Risks are minimal and similar to those of regular exercise and physical testing, including muscle soreness or fatigue. Blood draws carry a small risk of bruising or discomfort. A medical doctor will oversee all health screenings, and safety staff will be present during physically demanding tests to ensure participant safety throughout the study.

Where is the study run from?

The study is being conducted at two Texas fire departments — Lake Travis Fire Department and Fort Worth Fire Department — with training and testing occurring at the fire stations. Laboratory-based testing will be conducted through Sam Houston State University.

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

The study runs approximately 12 weeks per participant, with testing occurring at the start, after one week, and after twelve weeks.

Who is funding the study?

This research was funded through an internal Faculty Research and Creative Scholarship Grant from Sam Houston State University's College of Health Sciences (COHS; Huntsville, Texas). The COHS was not involved in data collection, statistical analysis, or the decision to publish the data.

Fluid Sports Nutrition provided in-kind material support in the form of the study supplement (Creapure® creatine monohydrate and matched placebo) at no cost. Fluid Sports Nutrition had no role in study design, data collection, analysis, interpretation of results, or the decision to submit for publication.

Who is the main contact?

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Additional identifiers**Study information****Scientific Title**

Effects of short- and long-term creatine monohydrate supplementation combined with resistance training on occupational, physical, and cognitive performance in career firefighters: a randomized, double-blind, placebo-controlled trial

Acronym

FIRE-CrM

Study objectives

Study Aims Primary Objective: To assess the impact of short-term (7-day loading, 20 g/d) and long-term (12-week maintenance, 5 g/d) creatine monohydrate (CrM) supplementation, combined with structured resistance training (RT), on occupational, physical, and cognitive performance in career firefighters.

Hypothesis: CrM supplementation combined with RT will produce significantly greater improvements in occupational, physical, and cognitive performance compared to placebo, following both the 7-day and 12-week interventions.

Specific Aim 1 (SA1): To determine whether 7-day (20 g/d) and 12-week (5 g/d) CrM supplementation, combined with RT, improves physical and cognitive performance outcomes — including resting hemodynamics, anthropometrics, body composition, cognitive function, mood state, and cardiopulmonary exercise capacity — assessed pre- and post-intervention via lab-based testing.

Specific Aim 2 (SA2): To determine the impact of CrM, combined with RT, on firefighter occupational performance and physiological response to a simulated fire-ground test (FGT), assessed pre- and post-intervention via field-based testing of occupational performance and metabolic response.

Rationale/Significance: Findings from this study will inform evidence-based supplementation and resistance training recommendations to improve physical, cognitive, and occupational performance, health, and readiness among firefighters, with potential applicability to other tactical populations.

Ethics approval required

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Ethics approval(s)

Approved 05/12/2025, Sam Houston State University (SHSU) Institutional Review Board (1905 University Avenue, Huntsville, 77340, United States of America; +1 936.294.4875; orsp_compliance@SHSU.EDU), ref: Assurance No. FWA00002405; IRB-2026-25

Primary study design

Interventional

Allocation

Randomized controlled trial

Masking

Blinded (masking used)

Control

Placebo

Assignment

Parallel

Purpose

Treatment

Study type(s)

Health condition(s) or problem(s) studied

Enhancement of occupational physical performance and mitigation of cardiovascular disease risk in career firefighters

Interventions

Participants will be randomly allocated to one of two parallel groups: a creatine monohydrate (CrM) group or a placebo (PLA) group. Randomization will be performed by an individual not directly involved in study procedures, who will assign treatments to coded, blinded containers labeled "A" and "B" to maintain double-blinding of both participants and researchers.

The CrM group will receive creatine monohydrate (Creapure®, Germany) administered orally as a powder mixed into a beverage, following a short-term loading dose of 20 g/day (4 x 5 g servings) for 7 days, followed by a long-term maintenance dose of 5 g/day (1 x 5 g serving) for the remaining 11 weeks (total supplementation period: 12 weeks).

The PLA group will receive an odor- and color-matched placebo (maltodextrin), administered in an identical delivery format, dosing schedule, and duration as the CrM group (20 g/day for 7 days, followed by 5 g/day for 11 weeks).

Both groups will concurrently participate in an identical, structured 12-week resistance training (RT) program, supervised by a Tactical Strength and Conditioning Facilitator (TSAC-F), consisting of three sessions per week (four sessions during weeks 1, 4, 7, and 10), performed on-shift at the

fire station. Each session will include a 10-minute cardiovascular and dynamic warm-up, followed by strength, power, hypertrophy, and muscular-endurance-based circuit training using an undulating, non-linear periodization model.

Intervention Type

Supplement

Primary outcome(s)

1. Overall physical fitness, aerobic endurance, stamina, and strength, measured using the completion time (minutes:seconds) for the Fire Ground Test (FGT), a 13-task, firefighter-specific occupational simulation test while wearing full personal protective equipment (PPE) and self-contained breathing apparatus (SCBA), recorded via stopwatch (Deluxe Stopwatch, Model H-5671; Uline) at baseline (pre supplementation/intervention) and post 12 weeks

Key secondary outcome(s)

1. Cardiopulmonary exercise capacity measured using VO₂peak (mL/kg/min) via maximal symptom-limited cardiopulmonary exercise test (CPXT) at baseline (pre supplementation/intervention) and post 12 weeks

2. Cognitive function measured using a Psychomotor Vigilance Task Test reaction time (ms) at baseline (pre supplementation/intervention) and post 12 weeks

3. Lower-body power output measured using vertical jump height (cm), at pre-FGT at baseline (pre supplementation/intervention) and post 12 weeks

4. Blood lactate response to the FGT measured using standard methods to assess capillary blood lactate (mmol/L), at pre-FGT (5-min prior) and post-FGT (5, 10, & 20 min) at baseline (pre supplementation/intervention) and post 12 weeks

5. Heart rate response to FGT measured using average heart rate (bpm) via Polar H10 monitor at pre-, and post-FGT at baseline (pre supplementation/intervention) and post 12 weeks

6. Air utilization / work efficiency during FGT measured using air cylinder pressure depletion (PSI) pre/post-FGT; work efficiency = $[(1/(\text{FGT time} \times \Delta\text{PSI})) \times 10^4]$ (lb·in²·min⁻¹), at baseline (pre supplementation/intervention) and post 12 weeks

7. Mood state measured using the Profile of Mood States (POMS) questionnaire score at baseline (pre supplementation/intervention) and post 12 weeks

8. State anxiety and felt arousal surrounding FGT measured using 6-Item State-Anxiety Scale (STAI-6) and 1-Item Felt Arousal Scale (FAS), at 30-min pre-, immediately post-, and 30-min post-FGT at baseline (pre supplementation/intervention) and post 12 weeks

9. Body composition measured using Fat mass, fat-free mass, body fat % via Bioelectrical Impedance Analysis (BIA) at baseline (pre supplementation/intervention) and post 12 weeks

10. Resting hemodynamics measured using resting heart rate (bpm) and blood pressure (mmHg) after 6-min rest at baseline (pre supplementation/intervention) and post 12 weeks

11. Anthropometrics measured using height (cm), weight (kg), waist and hip circumferences (cm) at baseline (pre supplementation/intervention) and post 12 weeks

Completion date

14/05/2026

Eligibility

Key inclusion criteria

1. Between 18 and 50 years old
2. A LTFD & FWFD career male or female firefighter
3. Provide written informed consent to participate in the study
4. Able to comply with study procedures and timeline
5. Agree to refrain from alcohol intake and use of non-steroidal anti-inflammatory drugs (NSAIDS), aspirin, and other over-the-counter pain medications for 48 hours before, during, and after each testing session
6. Have the ability to complete the study based on the duration of individual visits and scheduling requirements
7. Willing and able to abstain from creatine-containing supplements for a minimum 6-week washout period prior to baseline testing

Healthy volunteers allowed

Yes

Age group

Adult

Lower age limit

18 Years

Upper age limit

50 Years

Sex

All

Total final enrolment

24

Key exclusion criteria

1. Current use of creatine-containing supplements within the 6-week washout window prior to enrollment
2. Known renal, hepatic, or cardiovascular disease contraindicating creatine supplementation or maximal exercise testing
3. Pregnancy or breastfeeding
4. Use of weight-loss supplements within the 2 weeks prior to enrollment
5. Currently taking prescription medications known to affect muscle metabolism, hydration status, or cardiovascular/hemodynamic response to exercise
6. Musculoskeletal injury or orthopedic limitation precluding participation in resistance training or fire-ground task simulation
7. Known allergy or hypersensitivity to creatine monohydrate or study supplement excipients
8. Participation in another clinical trial or investigational supplement/drug study within 30 days of enrollment

Date of first enrolment

16/02/2026

Date of final enrolment

19/02/2026

Locations

Countries of recruitment

United States of America

Sponsor information

Organisation

Sam Houston State University

ROR

<https://ror.org/00yh3cz06>

Funder(s)

Funder type**Funder Name**

Sam Houston State University

Alternative Name(s)

Sam Houston Normal Institute, Sam Houston State Teachers College, Sam Houston State College, Sam Houston, Sam, SHSU

Funding Body Type

Government organisation

Funding Body Subtype

Universities (academic only)

Location

United States of America

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary

Not expected to be made available

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet		12/04/2025	03/09/2026	No	Yes