Condensed version and key points from the study:

The Effects of Supersaturated Hydrogen-Rich Water Bathing on Biomarkers of Muscular Damage and Soreness Perception in Young Men Subjected to High-Intensity Eccentric Exercise

Study Overview

- A double-blind, crossover pilot study published in the Journal of Sports Medicine (October 2020), conducted at the University of Novi Sad, Serbia, investigating whether a single session of whole-body bathing in supersaturated hydrogen-rich water (HRW) could reduce biomarkers of muscular damage and ease soreness perception in young men subjected to high-intensity eccentric exercise.

What Is DOMS and Why It Matters

- High-intensity eccentric exercise can cause delayed onset of muscle soreness (DOMS) — a short-term condition characterised by muscle damage and tenderness that appears approximately 24–48 hours after strenuous eccentric exercise, as a consequence of microscopic injuries to contractile proteins accompanied by inflammation. Although DOMS plays an important role in muscle remodelling and favourable adaptations, its extended duration may occasionally jeopardise exercise routine and cause more harm than good.

What Makes This Study Different — The Delivery Method

- This is the first study in this series focused on bathing in hydrogen-rich water rather than drinking it or inhaling it. Hydrogen appears to penetrate the skin easily and is distributed throughout the whole body via the blood in approximately 10 minutes, as measured by hydrogen gas content in expired breath.
- Previous studies on hydrogen baths used lower concentrations and shorter immersion times (20 minutes). This study employed a highly supersaturated concentration of 8 mg of H_2 per litre and a longer 30-minute immersion, which the authors propose may have been key to its stronger results.

Participants & Design

- Six healthy, active young men (mean age 24 years) participated in a double-blind crossover design, meaning each participant received both the hydrogen bath and the control bath on separate occasions with a two-week washout period between sessions. Control tablets were specially formulated to produce CO_2 bubbles visually mimicking hydrogen bubbles, maintaining effective blinding.
- The DOMS-inducing protocol consisted of 5 sets of 10 eccentric bilateral leg press contractions at 120% of one-repetition maximum, followed by 2 sets at 100% of one-repetition maximum. Immediately after exercise, participants were immersed up to the neck in a 200-litre bathtub for 30 minutes at thermoneutral temperature (28°C).

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Blood Biomarkers Measured

- Serum levels of creatine kinase (CK), lactate dehydrogenase (LDH), aldolase, aspartate transaminase (AST), troponin, myoglobin, high-sensitivity CRP, and white blood cell count were assessed at baseline (before exercise) and at 24-hour follow-up. Muscle soreness was rated using a Visual Analogue Scale (VAS) immediately after exercise, immediately after bathing, and at 24-hour follow-up.

Key Results — Blood Markers

- A single session of bathing in HRW prevented any rise in circulating biomarkers of muscular damage at 24-hour follow-up, retaining the levels of all biomarkers similar to baseline values. In contrast, serum CK, aldolase, and AST were all significantly elevated at 24-hour follow-up compared to baseline after the control bath.
- Two-way ANOVA revealed a significant difference between the two groups in serum CK response over the period of intervention (P=0.04) — with the HRW group maintaining near-baseline CK levels (343 ± 309 U/L at baseline vs. 357 ± 189 U/L at follow-up), while the control group showed a meaningful rise (343 ± 309 U/L vs. 465 ± 295 U/L).

Key Results — Muscle Soreness (VAS)

- HRW bathing induced a significantly greater reduction in VAS scores for muscular soreness compared to the control bath, both immediately after the intervention (32.7 ± 8.6% vs. 20.0 ± 12.8%; P=0.02) and at 24-hour follow-up (31.6 ± 24.3% vs. 22.4 ± 27.5%; P=0.03).
- In practical terms: the hydrogen bath produced roughly 50% more pain relief than the plain water bath, both immediately and the next day.

Safety

- No participants reported any major side effects during the trial. One participant disclosed a localised, mild, and fleeting burning sensation when a semi-dissolved tablet touched the skin during the HRW bath.

T**he Proposed Mechanism**

- Previous studies suggested that hydrogen baths did not significantly affect oxidative stress biomarkers or cytokine responses, suggesting that oxidative stress reduction alone may not fully explain hydrogen's benefits on muscle soreness. An alternative hypothesis is that HRW bathing could maintain the muscle cell membrane (sarcolemma) intact — or less permeable — to enzyme leakage, by stabilising muscle cell viability through acute modulation of central nuclei-related mechanisms. This possibility should be explored in forthcoming studies.
- It is also possible that hydrogen affects gene expression, though this likely occurs in slower dynamics, whereas the bathing effects appear comparatively rapidly.

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Why CK Specifically Matters for Athletes

- Serum CK concentration peaks at 24 hours after DOMS-inducing exercise and then decreases approximately 35% per day back to baseline. In general terms, a training break is suggested to athletes who experience high CK after exercise to enable myocyte regeneration and remodelling. However, a prolonged hiatus may disrupt a dense exercise schedule in many professional sports requiring day-to-day training practice. Any intervention that enables faster recovery in terms of keeping serum CK equilibrium might therefore be of high importance for professional and recreational athletes.

Conclusions

- Whole-body bathing in supersaturated HRW is a safe novel recovery protocol that attenuates muscular damage and can ease sore muscles after high-intensity eccentric exercise in active healthy men. The promising results of this pilot study should be corroborated and expanded in well-powered longitudinal trials with various athletic populations.

Limitations to Keep in Mind

- The study employed only a single session of HRW bathing, preventing evaluation of the safety and efficacy of repeated baths and monitoring beyond 24 hours. There may also be differences in the physiological effects of HRW baths among different exercise protocols, modalities (running, cycling, arm exercise), women, and age-specific groups. No information was provided on whether HRW preserves muscular performance in terms of power, strength, and endurance.
- With only 6 participants, this is an extremely small sample — a pilot study by design. While the crossover design improves statistical power, the results must be considered preliminary.
- One of the study's funders was HRW Natural Health Products Inc., the company that supplied the hydrogen bathing tablets — a potential conflict of interest worth noting, even though the authors declared no conflicts.
- The study focused exclusively on young active men, so applicability to women, older adults, or elite athletes with higher baseline CK levels remains unknown.
- The precise mechanism by which hydrogen bathing suppresses CK release remains unconfirmed — it is not yet clear whether it reflects reduced muscle damage, enhanced CK clearance, or membrane stabilisation.

To Read The Full Study Please CLICK HERE