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ORIGINAL ARTICLE

Is molecular hydrogen beneficial to enhance post-exercise recovery in female athletes?



Est-ce que l'hydrogène moléculaire est bénéfique pour améliorer la récupération après l'effort chez les athlètes féminines ?

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Summary

Objectives. – The purpose of this double-blind, randomized, placebo-controlled crossover study was to determine the effects of pre-exercise hydrogen-rich water intake on biomarkers of acid-base homeostasis and post-exercise recovery in female athletes.

Methods. – Eight young female judo athletes (21.4 ± 2.2 years) were randomly assigned to receive either hydrogen-rich water or placebo water ~ 30 minutes before exercise. The same procedures were repeated 4 days after the first assessment in a crossover design. The exercise protocol consisted of high-intensity intermittent exercise by means of a judo-specific test. Heart rate was recorded at baseline and post-exercise. Participants' blood was sampled in order to determine the arterial blood pH, bicarbonates and lactates at rest (prior to the intervention), 3 minutes and 5 minutes post-exercise.

Results. – Hydrogen-rich water significantly affected post-exercise blood pH and lactates as compared to the placebo ($P < 0.05$), while serum bicarbonate responses did not differ between interventions. No differences were found between hydrogen-rich water and placebo in heart rate responses to exercise. No side effects of either intervention were noted.

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MOTS CLÉS

L'eau riche en hydrogène ;
Récupération ;
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Conclusion. – Hydrogen-rich water might be an appropriate and safe hydration strategy that helps athletes to become less susceptible to exercise-induced acidosis.

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Résumé

Objectifs. – Le but de cette étude croisée randomisée et en double insu était de déterminer les effets de l'ingestion avant l'effort d'eau riche en hydrogène sur les biomarqueurs de l'équilibre acidobasique et sur la récupération post-exercice chez les athlètes féminines.

Méthodes. – Huit jeunes athlètes féminines du judo ($21,4 \pm 2,2$ ans) ont été réparties de manière aléatoire pour ingérer l'eau riche en hydrogène ou un placebo ~ 30 minutes avant l'exercice. Le même protocole a été appliqué 4 jours après la première évaluation selon un plan croisé. Le protocole d'exercice consistait en un effort intermittent de haute intensité lors d'un test spécifique de judo. La fréquence cardiaque était évaluée avant et après l'effort. Le sang des participants a été prélevé afin de déterminer le pH, les bicarbonates et les lactates artériels au repos (avant de l'intervention), 3 minutes et 5 minutes après l'exercice.

Résultats. – Le pH et le lactate sanguins ont été significativement modifiés avant de l'intervention avec l'eau riche en hydrogène par rapport au placebo ($p < 0,05$), alors que les réponses de bicarbonate sérique ne différaient pas entre les interventions. Il n'y avait pas de différences entre les groupes en ce qui concerne la réponse de la fréquence cardiaque à l'effort. Aucun effet secondaire de l'eau riche en hydrogène n'a été relevé.

Conclusion. – L'eau riche en hydrogène pourrait être une stratégie d'hydratation appropriée et sécuritaire qui aide les athlètes à devenir moins sensibles à l'acidose induite par l'exercice.

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1. Introduction

It is well known that an accelerated post-exercise recovery provides numerous benefits for an athlete, such as improved performance, or reduced incidence of overtraining [1,2]. An optimal recovery seems to be of special importance in sports characterized by high training and/or competition loads, such as judo or other combat sports [3,4]. High-intensity exercise could induce disturbances in the body's acid-base homeostasis, and this exercise-induced acidification might negatively affect both performance and post-exercise recovery [5]. Hence, in order to manage exercise-induced metabolic acidosis and support intrinsic buffering systems, athletes often use different nutritional and pharmacological agents that may positively affect blood or muscular pH [6]. Traditionally, bicarbonate supplements have been reported as a useful tool for alleviating acidosis and improving exercise performance [7–9]. However, potential side effects of oral bicarbonates (e.g. stomach pain, diarrhea, nausea, vomiting) impede its wider application in the athletic environment [10]. Hydrogen-rich water (HRW) has recently appeared as a novel and safe nutritional agent that might have beneficial effects for athletes. Our group has reported that HRW exhibits a high pH and positively affects exercise-induced acidosis in healthy men [11,12]. When administered for 7 days, 2 L of HRW daily increased fasting and post-exercise blood pH for ~ 6% in healthy men, with no adverse effects reported [11]. This blood-alkalizing effect of HRW has been confirmed in another study, where intake of HRW significantly increased fasting arterial blood pH by 0.04 in 52 healthy men supplemented with 2 L/day of HRW for 14 days [12]. Previous studies with HRW used

continuous exercise protocols (e.g. running to exhaustion) while no study so far evaluated the effectiveness of HRW during intermittent exercise loads, usually characterized by significant acidosis [13]. In particular, HRW might be specifically helpful in judo which is distinguished by high anaerobic demands and a decrease in pH after exercise [14]. However, no information is currently available concerning the effectiveness of HRW in judo neither in female athletes. Therefore, the purpose of this double-blind, randomized, placebo-controlled crossover study was to determine the effects of pre-exercise HRW administration on biomarkers of acid-base homeostasis and post-exercise recovery in female judo athletes.

2. Methods**2.1. Subjects**

Eight female judo athletes (age of 21.4 ± 2.2 years, weight of 67.9 ± 11.0 kg, height of 168.8 ± 7.2 cm) were recruited for this pilot study. Participants were well-experienced athletes (professional judo experience of ~ 3 years) who train approximately 10 hours per week and were free from any dietary supplements for the past 6 months. All participants were in excellent health, without cardiovascular, respiratory or endocrine system diseases, as the preliminary medical screening confirmed. The participants were informed about the nature and demands of the study and gave their written consent. All procedures were performed in accordance with the Declaration of Helsinki, and the study was approved by the local Institutional Review Board.

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