

How does Hydration Affect Glycogen Levels in Athletes?

A high-frequency ultrasound transducer sees various quantities of water in tissue. When a molecule of glycogen leaves the muscle, it takes 3-4 molecules of water with it. MuscleSound® measures the related water loss when athletes metabolize their muscle glycogen. Many people ask, “Could this just be dehydration?”

Our first study involved professional road cyclists (the Garmin team) during a VO2 max test in 2010. Most of the cyclists exerted themselves on an ergometer for about one hour and we followed lactate levels and oxidative metabolism along with muscle ultrasound measurements. The riders experienced sweat loss, and did not replace fluids during this first test. We expected to see a decrease in quadriceps measurements over time, but these measurements increased by an average of one centimeter. MuscleSound® discovered that this was related to blood vessel dilation, even though the muscle tissue decreased in size. The ultrasound measurements and lab values were tightly correlated in this study, however we thought this could still be due to dehydration.

Over a two-week period during spring training in early January 2010, we allowed the riders in the study to drink and replace fluids during the testing. We weighed them before and after exertion and easily controlled for dehydration. As long as the athletes did not eat during the rides, we saw the same ultrasound changes as we did in the first part of the study. The appearance of the athletes’ muscles changed from dark to light (hypoechoic to hyperechoic). During long rides when the cyclists would eat and drink, and the majority of their exertion remained below their lactate threshold (which we confirmed by random blood tests), the athletes’ muscles retained good glycogen stores and appeared hypoechoic on post-performance ultrasound scans. MuscleSound® has since reproduced the same results with marathon runners and another group of professional cyclists (the United Healthcare team).



John C. Hill, DO, FAAFP, FACSM

Professor

Director of Primary Care Sports Medicine
Fellowship

University of Colorado School of Medicine

MuscleSound® co-founder