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Postworkout Carbohydrate and Protein Supplementation

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summary

New research has shown that consuming carbohydrate and protein after exercise speeds the recovery process and optimizes the adaptive response.

If you think that having your athletes sip a carbohydrate drink postworkout is enough to promote their recovery, think again. In a perfect world, nutrition during the postexercise period does 3 things: (a) it rapidly initiates the process of muscle glycogen regeneration, (b) it decreases exercise-induced muscle protein breakdown, and (c) it increases muscle protein synthesis. Although it is well known that ingesting carbohydrates after exhaustive exercise can help regenerate muscle glycogen stores, recent experiments have revealed that the combination of carbohydrates and protein leads to even greater increases in skeletal muscle glycogen. Carbohydrate-protein mixtures also have another important advantage: the stimulation of muscle protein synthesis and tissue repair. In fact, ingesting amino acids and carbohydrates postexercise can increase muscle protein synthesis 350% above fasted baseline values, compared with only a 200% increase from ingesting amino acids alone.

In a two-part study at Maastricht University in the Netherlands, scientists examined the effects of a carbohydrates-only drink (1.2 g/kg per hour of 60:40% maltodextrin/glucose) and the carbohydrates drink plus 0, 0.2, or 0.4 g/kg per hour of a protein hydrolysate and amino acid mixture on insulin responses (2). Eight male cyclists ingested these beverages every 30 minutes for 3 hours after a glycogen-depleting bike ride. Results indicated that beverages containing only the carbohydrates and protein produced significant insulin responses (+52% and +107% for the 0.2 and 0.4 g/kg per hour drinks, respectively). Because elevated insulin concentrations can increase glycogen synthase activity, similar drinks were subsequently examined for their ability to regenerate muscle glycogen. Muscle biopsies taken from the vastus lateralis indicated that the addition of protein hydrolysate and certain amino acids doubled glycogen synthesis rates compared with carbohydrates alone.

In another study designed to assess whether carbohydrate-protein mixtures could enhance muscle glycogen storage (1), subjects were asked on 3 separate occasions to perform intense cycling to deplete muscle glycogen stores (i.e., 2.5 hours at 65–75% of V_{O_2}max followed by a series of 1-minute sprints at maximal effort). Ten minutes and 2 hours into the recovery period, subjects drank the following formulas: trial 1, Carb-Pro-Fat (80 g carbohydrates, 28 g protein, 6 g fat); trial 2, High Carb-Fat (108 g carbohydrates, 6 g fat); and trial 3, Low Carb-Fat (80 g carbohydrates, 6 g fat).

13C nuclear magnetic resonance spectroscopy scans were performed at baseline and at various intervals postexercise to assess changes in muscle glycogen content of the vastus lateralis. After 4 hours of recovery (remember, subjects consumed each supplement twice—10 minutes after

exercise and again 2 hours later), researchers found that muscle glycogen was significantly greater for the Carb-Pro-Fat trial compared with either of the other 2 trials. Specifically, the Carb-Pro-Fat trial had a muscle glycogen concentration of 88.8 mmol/L, which is approximately 18% greater than trial 2 (75.5 mmol/L) and 27% greater than trial 3 (70.0 mmol/L). In addition, the rate of muscle glycogen regeneration during the 4-hour recovery period was 2 to 4 times faster during the Carb-Pro-Fat trial compared with the other 2 trials. These differences are intriguing because during trials 1 and 2 the subjects consumed the same amount of total energy (1,587.6 kJ per drink).

Finally, a recent study from the University of North Texas and the University of Texas at Austin extended the findings of previous studies by examining the effects of carbohydrate-only versus carbohydrate-protein mixtures on performance (3). Researchers compared a carbohydrate-protein beverage (Endurox R4: 53 g carbohydrates, 14 g protein, 1.5 g fat, added vitamins, minerals, and amino acids) with a 6% carbohydrate-electrolyte sports beverage (Gatorade: 21 g carbohydrates, 0 protein or fat) administered immediately after 2 hours of glycogen-depleting exercise and then again at 2 hours postexercise. During a subsequent performance test at 85% of $\dot{V}O_2$max, researchers found that (a) time to exhaustion was 55% greater during the carbohydrate-protein trial and (b) the rate of glycogen storage (assessed from muscle biopsies of the vastus lateralis) in the carbohydrate-protein trial was 128% greater than in the carbohydrate-electrolyte sports-beverage trial. This may have been because of the much higher plasma glucose (17%) and insulin (92%) response seen in the carbohydrate-protein trial.

Well-informed coaches understand that postexercise nutrition is critical to achieve optimal physical performance. At this point, a combination of carbohydrates, protein, and possibly a small amount of fat appears to be the best bet. ♦

References

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