

**Carbohydrate Supplementation and Resistance Exercise Performed by Males Undergoing
Energy Restriction**

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CARBOHYDRATE SUPPLEMENTATION AND RESISTANCE EXERCISE PERFORMANCE IN MALES UNDERGOING ENERGY RESTRICTION

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(Abstract)

This study examined the effects of carbohydrate supplementation on resistance exercise performance, cortisol levels, and creatine kinase levels in males undergoing energy restriction. Twenty-two trained male resistance trainers participated in the study. Sixteen experimental subjects were randomly assigned to a carbohydrate group (C, n=8) or a placebo group (P, n=8). The remaining six subjects served as a control group (N) to control for possible effects of repeated testing on resistance training performance. N did not participate in energy restriction or blood draws. All subjects were assigned standardized workouts and participated in resistance performance tests. The standardized workouts consisted of five sets of parallel squats, bench press, leg press, and leg extension. The resistance for the five sets of each exercise was 80%, 80%, 70%, 60% and 60% of 10RM. The performance test was almost identical to the workout except the final sets of bench press and one-legged leg extensions were done to failure at 80% of 10RM. Two of these tests were done before energy restriction (Trials 1 and 2) and one was done after energy restriction (Trial 3). Subjects in the experimental groups consumed a low calorie formula diet for three days ($18 \text{ kcal}^{-1} \text{ kg}^{-1} \text{ d}^{-1}$). They also had blood drawn before, 10 minutes post, 6 hours post, and 24 hours post exercise on the days of Trials 2 and 3. For Trial 3, after a resting blood draw, subjects consumed either a carbohydrate (1 g kg^{-1}) or a placebo beverage that was artificially sweetened 30 minutes prior to beginning the performance test.

Carbohydrate supplementation had no effect on resistance exercise performance, blood glucose, cortisol, creatine kinase, or RPE. The number of repetitions performed during the final set of bench press showed significant interaction between groups and time. P and N increased the number of repetitions performed from Trial 2 to Trial 3 (15.0 ± 1.4 to 17.3 ± 0.8 for P, 15.0 ± 2.7 to 16.7 ± 2.3 for N). C decreased the number of repetitions performed 17.6 ± 0.7 to 17.3 ± 1.0). Performance as measured by the number of repetitions performed during the final set of leg extensions showed no interaction between groups and time ($p=0.801$). There was a significant increase in CK after exercise when experimental groups were collapsed for Trials 2 and 3. During Trial 2, CK was elevated 16% 10 minutes after exercise and 54% 6 and 24 hours post exercise relative to the pre-exercise concentration. During Trial 3, CK was elevated 29% 10 minutes post, 36% 6 hours post, and 47% 24 hours post exercise. When the data for both experimental groups were collapsed, there was a significant increase in pre exercise cortisol levels following energy restriction ($252.1 \text{ nmol/L} \pm 12.0$ versus $306.5 \text{ nmol/L} \pm 17.0$).

In summary, the resistance weight training bout used in this study caused an increase in CK, suggesting muscle damage. This was in spite of the fact that these subjects were resistance trained. Energy restriction did not influence extent of muscle damage but increased resting cortisol levels. Carbohydrate consumption prior to exercise did not affect performance or metabolic status of the athletes. Thus, this study did not support a benefit of consuming

carbohydrate prior to resistance exercise for dieting athletes but illustrates that energy restriction increases a catabolic hormone.