Tocotrienols and Whey Protein Increase Exercise Capacity in Diet -Induced Obese Male Sprague-Dawley Rats

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Background and Aims: Obesity and impairments in metabolic health are associated with reductions in exercise capacity. Both whey protein isolates (WPIs) and vitamin E tocotrienols (TCTs) exert favorable effects on obesity-related metabolic parameters. It has previously been shown that TCTs supplementation in male Wistar rats improved swimming exercise endurance by nearly 2-fold and that despite the longer exercise duration, the TCT group had higher liver and muscle glycogen levels post exercise (Lee *et al.* 2009). This research sought to determine whether these supplements improved treadmill running exercise capacity, and metabolic phenotype in diet-induced obese rats.

Methods: Six week old male Sprague-Dawley rats (n=35) weighing 187 ± 32g (mean ± SEM) were allocated to either: Control (n=9), TCT (n=9), WPI (n=8) or TCT + WPI (n=9) and placed on a high-fat diet (40% of energy from fat) for 10 weeks. Animals received 50mg/kg body weight and 8% of total energy intake per day of TCTs and/or WPIs respectively. Maximal treadmill running capacity was determined by using an incremental treadmill running test to exhaustion following 3-5 acclimatization periods. Maximal endurance capacity was determined a week later by a constant intensity running test to exhaustion at approximately 65% of the peak velocity achieved during the incremental running test. Food intake and body composition were determined throughout the study. Exercise capacity, skeletal muscle glycogen content and oxidative enzyme activity were assessed to determine if there were benefits of the supplementation on muscle metabolism. Glucose tolerance and insulin sensitivity tests were administered to determine if WPIs or TCTs could improve glucose regulation while fed a high fat diet.

Results: Both TCT and WPI groups ran >50% longer (2271 ± 185m and 2195 ± 265m respectively) than the Control group (1428 ± 139m) during the run to exhaustion test ($P<0.05$), TCT + WPI combined did not further improve exercise endurance (2068 ± 104m) . WPIs increased the maximum *in vitro* activity of beta-hydroxyacyl-CoA in the *soleus* muscle ($P<0.05$ *vs* Control) but not in the *plantaris*. Citrate synthase activity was not different between groups. Likewise, muscle glycogen was also not different between any of the groups, despite the TCTs and WPIs groups running significantly longer than the Control group. Neither supplement had any effect on weight gain, adiposity, glucose tolerance or insulin sensitivity.

Conclusion: Ten weeks of both TCTs and WPIs increased exercise endurance by 50% in sedentary, diet-induced obese rats. There did not appear to be a difference in enzyme activity to explain greater fat utilization and/or less carbohydrate useage, despite the longer exercise time. These positive effects of TCTs and WPIs were independent of body weight, adiposity or glucose tolerance.