

Interval Functional Electrical Stimulation Cycling and Nutritional Counseling Improves Lean Mass to Fat Mass Ratio and Decreases Cardiometabolic Disease Risk in Individuals with Spinal Cord Injury

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Abstract : Introduction: Obesity is at epidemic proportions in the spinal cord injury (SCI) population (66-75%), as individuals who suffer from paralysis undergo a dramatic decrease in muscle mass and a dramatic increase in adipose deposition. Obesity is a major public health concern which includes a doubling of the risk of heart disease, stroke and type II diabetes mellitus. It has been demonstrated that physical activity, and especially HIIT, can promote a healthy body composition and decrease the risk cardiometabolic disease in the able-bodied population. However, SCI typically limits voluntary exercise to the arms, but a high prevalence of shoulder pain in persons with chronic SCI (60-90%) can cause increased arm exercise to be problematic. Functional electrical stimulation (FES) cycling has proven to be a safe and effective way to exercise paralyzed leg muscles in clinical and home settings, saving the often overworked arms. Yet, HIIT-FES cycling had not been investigated prior to the current study. The purpose of this study was to investigate the body composition changes with combined HIIT-FES cycling and nutritional counseling on individuals with SCI. Design: A matched (level of injury, time since injury, body mass index) and controlled trial. Setting: University exercise performance laboratory. Subjects: Ten individuals with chronic SCI (C5-T9) ASIA impairment classification (A & B) were divided into the treatment group (n=5) for 30 minutes of HIIT-FES cycling 3 times per week for 8 weeks and nutritional counseling over the phone for 30 minutes once per week for 8 weeks and the control group (n=5) who received nutritional counseling only. Results: There was a statistically significant difference between the HIIT-FES group and the control group in mean body fat percentage change (-1.14 to +0.24) respectively, $p = .030$). There was also a statistically significant difference between the HIIT-FES and control groups in mean change in legs lean mass (+0.78 kg to -1.5 kg) respectively, $p = 0.004$. There was a nominal decrease in weight, BMI, total fat mass and a nominal increase in total lean mass for the HIIT-FES group over the control group. However, these changes were not found to be statistically significant. Additionally, there was a nominal decrease in the mean blood glucose levels for both groups 101.8 to 97.8 mg/dl for the HIIT-FES group and 94.6 to 93 mg/dl for the Nutrition only group, however, neither were found to be statistically significant. Conclusion: HIIT-FES cycling combined with nutritional counseling can provide healthful body composition changes including decreased body fat percentage in just 8 weeks. Future study recommendations include a greater number of participants, a primer electrical stimulation exercise program to better ready participants for HIIT-FES cycling and a greater volume of training above 30 minutes, 3 times per week for 8 weeks.

Keywords : body composition, functional electrical stimulation cycling, high-intensity interval training, spinal cord injury

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