TACSM Abstract

Thirty Minutes of Electrical Muscle Stimulation Improves Glycemic Control

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ABSTRACT

Electrical muscle stimulation is a suitable skeletal muscle contraction modality for people with physical functional disabilities and other sedentary individuals. While the extensive use of this technique has focused primarily on muscle strengthening and regeneration during rehabilitation, there is an increasing research interest to explore its potential to improve other metabolic health parameters similar to the benefits of conventional exercise. **PURPOSE**: This study aims to determine the effect of acute electrical stimulation on glycemic control in a predominantly Hispanic population. **METHODS**: Thirty-one participants (Males: 10; Females: 21; BMI: 33.3 ± 7.1 kg/m^2; Age: 35.1 ± 12.0 years) consisting of 77% Hispanics participated in the study. After an overnight fast, all participants underwent 30 minutes of electrical stimulation on both quadricep muscles while lying supine. The stimulation was performed at each participant's maximum tolerable intensity using a handheld QuadStar® II neuromuscular electrical stimulation device set at a frequency of 50Hz and pulse width of 300µs. Fourteen participants re-enrolled in this stimulation experiment for a second time after 8 weeks. Interstitial glucose levels were measured on the day of stimulation as well as the day before stimulation using a continuous glucose monitor (CGM) worn on the abdomen of each participant. CGM takes 24-hour glucose readings every 5 minutes. During these two days, each participant was provided with a standardized eucaloric diet (~55% carbohydrates, ~15% protein, & ~30% fat) for breakfast, lunch, dinner, and snacks. Post-stimulation glucose levels were analyzed for 30 minutes after the cessation of stimulation. One-way ANOVA with Tukey multiple comparisons was used to test for differences in glucose levels right before stimulation, during 30-minute stimulation, and 30-minute average post-stimulation periods. Paired t-test was used to compare 24-hour glycemic control on the day of stimulation vs the day before stimulation. Results are presented as mean ± SEM. **RESULTS**: Glucose levels reduced significantly during the 30 minutes post-stimulation (111.1 ± 3.0 mg/dL), compared to the stimulation period (114.4 ± 3.2 mg/dL) and at baseline before stimulation (113.6 ± 3.3 mg/dL) ($p<0.05$). Twenty-four-hour glycemic control determined by glucose variability/fluctuations (standard deviation), and maximum glucose excursion were all significantly lower on the day of stimulation compared to the day before stimulation (18.33 ± 1.4 mg/dL vs 21.4 ± 1.3 mg/dL and 176.7 ± 11.1 mg/dL vs 198.4 ± 7.3 mg/dL respectively) ($p<0.05$). The average 24-hour glucose level between the two days was not significantly different ($p>0.05$). **CONCLUSION**: Acute electrical muscle stimulation results in an effective reduction in blood glucose, glucose variability, and maximum glucose excursion - indicating better 24-hour glycemic control. Future studies should evaluate the feasibility and effectiveness of the long-term application of this technique in preventing and managing hyperglycemia among people with insulin resistance and diabetes.