TACSM Abstract

Role of Stimulation Intensity on Neuromuscular Electrical Stimulation Induced Changes in Energy Expenditure and Respiratory Quotient

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ABSTRACT

Neuromuscular Electrical Stimulation (NMES) is an alternative technique to stimulate muscle contraction for people who are unmotivated or experiencing physical impairments that prevent them from performing exercise. Previous studies have shown that the use of NMES-induced muscle contraction can increase energy expenditure (EE) and glucose utilization. However, it is unclear if the intensity of the NMES plays a role in the change in EE and glucose utilization. **PURPOSE**: To determine the effect of NMES intensity on NMES-induced changes in energy expenditure (EE) and whole-body substrate utilization. **METHODS**: Thirty-six sedentary overweight /obese men (n=15) and women (n=21) participated in this study (Age: 33.76 ± 12.74 years; BMI: 34.92 ± 7.25 kg/m^2). Seventeen of the participants were hyperglycemic (blood glucose ≥ 100 mg/dL), and nineteen participants were normoglycemic (blood glucose < 100 mg/dL). Whole body energy expenditure and substrate utilization (assessed by respiratory quotient (RQ)) was measured for 50 minutes continuously via indirect calorimetry while lying in a supine position. After 20 minutes of baseline measurement, all participants received 30 minutes of NMES up to maximum tolerable intensity (pulse duration 300 µs; frequency 50 Hz) delivered via 4 electrodes on the quadricep muscles of both legs. Energy expenditure and RQ were measured every 5 minutes during stimulation and an average value of 30 minutes was calculated. Energy expenditure was normalized by body weight and changes in EE and RQ during stimulation were calculated, compared to baseline. Results were analyzed using GraphPad Prism (version 10). Pearson correlation was used to determine the relationship between intensity and change in EE and RQ in both hyperglycemic and normoglycemic groups. Paired t-test was used to compare baseline energy expenditure vs. stimulation energy expenditure and baseline RQ vs. stimulation RQ. **RESULTS**: Following the 30 minutes of stimulation, the participants had an increase in energy expenditure (18.89 ± 0.46 vs. 19.47 ± 0.55; p= 0.014) and a respiratory quotient trend (0.79 ± 0.008 vs. 0.80 ± 0.007; p= 0.083). Within the hyperglycemic group, NMES intensity was positively correlated with change in EE (r= 0.513; p= 0.034) but did not correlate with RQ. Within the normoglycemic group, NMES intensity was positively correlated with change in RQ (r= 0.473; p= 0.406) but not with EE. **CONCLUSION**: These findings indicate that the intensity of NMES plays a vital role in the increase in energy expenditure and glucose utilization during stimulation. High-intensity NMES may be beneficial to increase energy expenditure in overweight/obese, hyperglycemic individuals.