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Effect of Relaxation Breathing on Glycemic Response in Type II Diabetic Subjects

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Effect of Relaxation Breathing on Glycemic Response in Type II Diabetic Subjects

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Introduction

Stress on the human body can have a wide variety of detrimental effects. Stress can be associated with the release of counter-regulatory hormones that may be linked to an increase in blood glucose levels (Surwit, 2001). Type 2 diabetes is a metabolic disorder known to be associated with insulin resistance. Increased physical activity is used in conjunction with healthy diets to improve and control insulin sensitivity. High stress levels result in insulin resistance, glucose intolerance and physical ailments such as hypertension and obesity.

Yoga has been shown to improve glycemic response, help reduce stress, and improve insulin sensitivity. Yoga consists of a series of physical maneuvers that include controlled relaxed breathing (Malhotra et al 2005). Insulin sensitivity changes could result from either the relaxation breathing or the physical maneuvers, or a combination of the two yogic components. The relaxation breathing component may lower stress and represent an alternative to traditional pharmaceutical treatments for improving glycemic response in type 2 diabetic subjects. There are a variety of different relaxation breathing exercises that are used in the different forms of yoga, comparing different yoga forms is problematic in this regard.

Our previous study (Wilson, 2012) conducted with healthy, college age students at Winona State University used a simple reproducible relaxation breathing exercise (Figure 1). We sought to determine if the breathing component by itself could acutely improve glycemic response after consumption of an oral glucose tolerance test. Significant improvements in glycemic response were observed in these healthy subjects.

The aim of the present study was to determine if the same simple reproducible relaxation breathing exercise could be beneficial for improving glycemic response in type 2 diabetic subjects.

Methods

The WSU Human Subjects Committee approved this study for type 2 diabetic subjects. Subjects (n=9; 62.0 ± 9.3 yrs; BMI 31.0 ± 6.5, HbA_1C 7.1 ± 0.6) were randomized in a double-cross over design. Following a 9 hour fast from food/medications and a 30 minute acclimation period of control breathing (CB) or relaxation breathing (RB), baseline blood glucose was measured (0 min) prior to an oral glucose tolerance test drink (OGTT; 50g/240mL). Blood glucose was measured 30, 60, 120 min post OGTT. Blood samples were collected via finger prick in heparinized capillary tubes at each time period for evaluation of plasma insulin concentrations (ELISA, Alpco Diagnostics Inc.). A RB exercise was developed to guide the subjects through the exercise to ensure consistency between subjects. The pre-recorded exercise (http://course1.winona.edu/ewilson/) played continuously as a self-repeating loop every 10 minutes during the 30 minutes prior to the OGTT and throughout the 90 minute OGTT. The relaxation breathing exercise used is described in Figure 1 and involved a cycle of deep inhalations with increasingly long exhalations.

Data are represented as mean ± standard error. Repeated measures analysis with a Tukey-Kramer adjustment for multiple comparisons was completed in SAS Version 9 to track each subject over time points. Compound symmetry was used as the covariant structure. A quadratic contrast test for trend was used to verify quadratic trends in the data. Area under the curve and estimated peak times were calculated using quadratic equations. Differences were considered significant if $P < 0.05$.

Results

Figure 1. Relaxation breathing exercise used in this study.

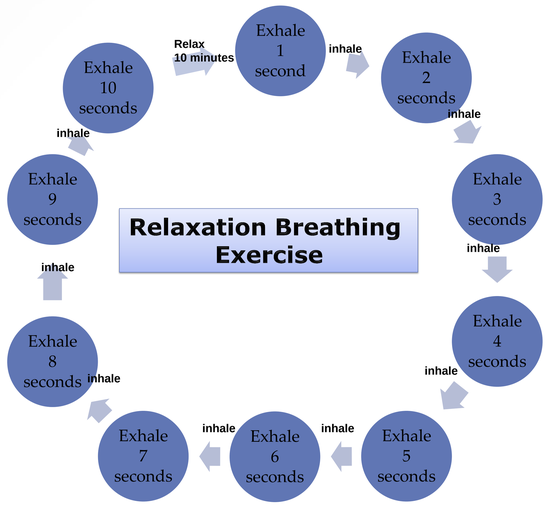


Table 1. Heart rate for RB and Control groups during 120 minute study period. No significant differences were observed in time or treatment. If an unadjusted Tukey-Kramer analysis was applied to the statistical model the difference (RB-0 vs RB=120 and RB-120 vs CO-120) approached significance (P=0.06).

Mean heart rate (beats per minute)				
Group	**0 Min. Pre-OGTT**	**30 Min. Post-OGTT**	**60 Min. Post-OGTT**	**120 Min. Post-OGTT**
Control Breathing	70.8 ± 23.6	70.3 ± 23.4	76.1 ± 22.4	70.8 ± 23.6
Relaxation Breathing	69.4 ± 23.2	71.3 ± 23.8	66.9 ± 22.3	64.8 ± 21.5

Table 2. Blood oxygen concentration ($\%SpO_2$) for RB and Control groups during 120 minute study period. No significant differences were observed in time or treatment.

$\%SpO_2$				
Group	**0-minute Pre-OGTT**	**30-minute Post-OGTT**	**60 Min. Post-OGTT**	**90 Min. Post-OGTT**
Control Breathing	97.1 ± 32.4	96.5 ± 32.2	96.7 ± 32.2	95.4 ± 31.8
Relaxation Breathing	95.3 ± 31.8	96.3 ± 32.1	97.1 ± 32.4	96.2 ± 32.1

Figure 2. Blood glucose (mg/dl) before and after OGTT (50 gram) administration in control and relaxation breathing subjects. All values significantly different vs. 0-minute, no differences between groups were observed at any given time.

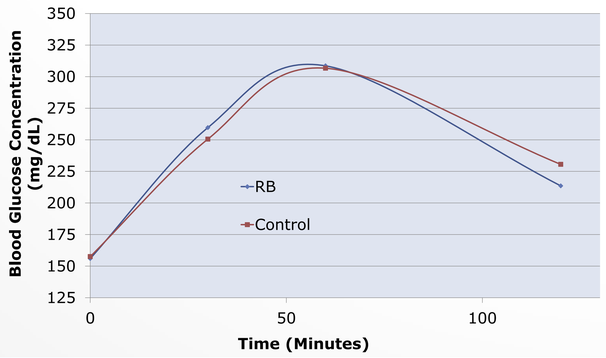


Table 3. Blood glucose (mg/dl) before and after OGTT (50 gram) administration in control and relaxation breathing subjects. No significant differences between groups were observed at times 0-, 30-, 60-, or 120-minutes.

Mean Blood Glucose Concentration (mg/dL)				
Group	**Baseline (Pre-OGTT)**	**30 Min. Post-OGTT**	**60 Min. Post-OGTT**	**90 Min. Post-OGTT**
Control Breathing	158±41	251±66	307±58	231±57
Relaxation Breathing	156±43	260±67	309±54	214±60

Figure 3. Average area under the curve values for glucose in RB and control treatments were not significantly different.

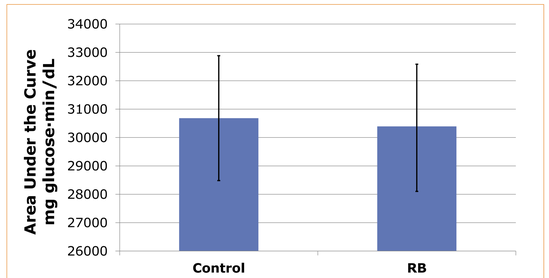
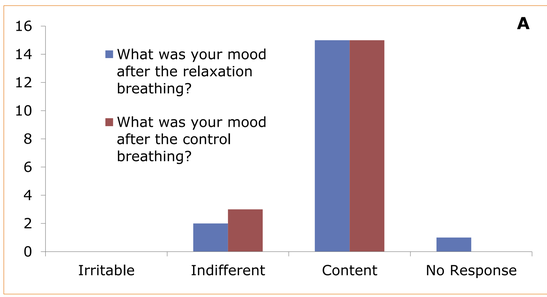
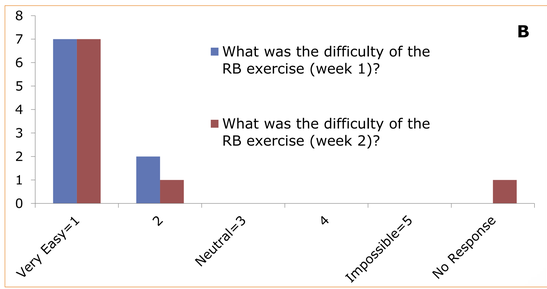
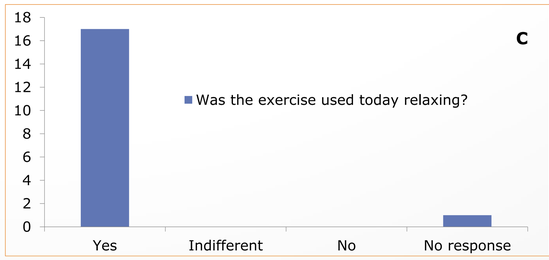


Figure 4. Individual Responses to exit questionnaire. A. Mood after relaxation breathing B. Difficulty of RB exercise C. Was RB a relaxing exercise







Summary of Main Points

•A simple reproducible relaxation breathing exercise was created to determine if the breathing component of yoga could improve glycemic control in type 2 diabetic subjects.

•RB was executed every 10 minutes throughout the OGTT, after a baseline glucose level (t=0) had been determined. Control breathing consisted of regular breathing patterns throughout the 120 minute time period.

•Plasma concentrations were not significantly different between RB and control groups over the course of the study.

•Glucose AUC between the RB and control groups were not significantly different. (RB= 30394; CB=30683mg·min/dL).

•The type 2 diabetes subjects showed a tremendous variation in glycemic response that probably prevented determination in whether or not relaxation breathing had a positive effect.

Conclusions

This relaxation breathing exercise did not significantly improve glycemic control in type 2 diabetic subjects. This pilot study demonstrated that even with a double cross over design, the 9 people were not sufficient for a complete evaluation of relaxation breathing as a treatment for type 2 diabetes, and suggests that a larger study population would be needed to truly evaluate and determine whether this approach is applicable.

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