

The Effects of a Combined Aerobic and Resistance Exercise Programme on Insulin Resistance among Prediabetes Subjects

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Abstract

Aim: Insulin resistance is a common health disorder that contributes to developed overt diabetes among prediabetes subjects. The aim of the study is to examine the effects of a combined programme of aerobic and resistance exercise on insulin resistance among prediabetes subjects (Pre-D) using Oral Glucose Tolerance Test (OGTT) as a tool to define the improvement in insulin resistance.

Method: 20 prediabetes subjects were asked to join a supervised combined exercise program consists of 30 min of resistance exercise followed by 20 min cycling twice at moderate-intensity a week for 6 weeks.

Result: a significant improvement in Blood Glucose (BG) after combination exercise at two occasions when compared to BG before exercise (Pre S1), after 1st exercise session (Post S1) and at the end of intervention trial (Post S12).

Conclusion: The result of this study has shown that 6 weeks of moderate-intensity exercise combined with aerobic and resistance exercise program had significantly ameliorated insulin resistance among Pre-D.

Keywords: Exercise; Aerobic exercise; Resistance training; Glucose tolerance; Glucose curve shape; Insulin resistance; Prediabetes; Oral glucose tolerance test

Introduction

Insulin resistance is a pathological disorder that can be defined as the failure of insulin to optimally encourage the transport of glucose from the bloodstream into the body's cells particular liver, adipose tissue, and muscles [1].

Over time the beta cells fail to maintain the body's increased need for insulin leading to prediabetes condition and other serious health disorders such as hyperlipidemia, hypertension and metabolic syndrome [2].

The etiology of insulin resistance is multifactorial including both environmental and genetic factors.

Although the exact causes of insulin resistance are not clearly understood, several researchers believe that excess weight and physical inactivity are the main contributing factors to insulin resistance besides other factors like ethnicity, older age and certain diseases [3].

Exercise has been suggested as an important non-pharmacotherapy intervention that might improve insulin resistance among subject at risked developing diabetes [4]. However, the extent to which exercise is effective to ameliorate insulin resistance among prediabetes subjects is not fully understood.

Thus the aim of this study is to examine the effects of a combined exercise programme AE and RE on improving insulin resistance among prediabetes subjects.

Methods

20 prediabetes subjects were asked to join a supervised combined exercise program consists of 30 min of resistance exercise followed by 20 min cycling at moderate intensity twice a week for 6 weeks.

The combined exercise program included warm-up consisted of 11 steps of stretching after that cycle for five minutes. The RE consists of three sets, in each set the volunteer performed (squat, chest, back, biceps and triceps) 10 times followed by 20 min cycling.

The OGTT was conducted on three different occasions at baseline, post first session and at the end of the intervention. The blood samples were centrifuged at 3000 rpm for 15 min at 4°C using a centrifuge [5].

Fisher Thermo Scientific, UK). Immediately post centrifuge the plasma was dispensed into labeled 1.5 ml Eppendorf tubes (Eppendorf, Germany) and stored in a -80°C freezer until analysis.

The plasma was analyzed by a commercially-available Enzyme-Linked Immunosorbent Assay (ELISA).

It is more likely that chronic exercise might offer the greatest effect on postprandial blood glucose profiles when compared to the acute exercise effect. Figure 1 exhibited glucose concentrations for each OGTT time point for 2 hours. It showed that the blood glucose peak in baseline was considerably higher than both Post 1st Exercise and post S12.

Result

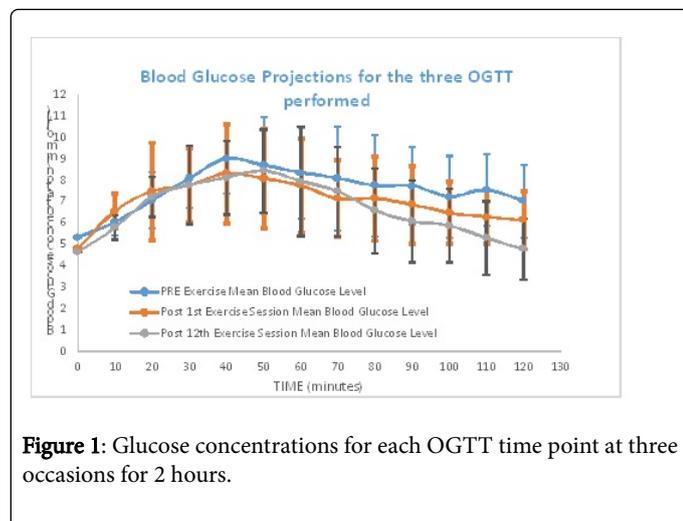


Figure 1: Glucose concentrations for each OGTT time point at three occasions for 2 hours.

The results revealed a significant improvement in BG after combination exercise at two occasions when compared to BG pre exercise (PRE Ex), after 1st exercise session (1st) and at the end of intervention trail (Post12) with the p-value as the following; (PRE Ex and Post S12)=0.003, (PRE Ex and Post S12)=0.001 and (Post 1st and Post S12)=0.024. P values show a significant reduction in BG especially when comparing (Pre Ex and Post S12) which illustrate that chronic exercise has a better effect on BG than acute exercise. The mean fasting glucose concentration in Post 1st Exercise and Post S12 were reduced by 10.8% and 15% respectively compared to the baseline. In addition, the mean of glucose concentration post-one-hour of load glucose for both Post 1st Exercise and post S12 were less than 8.6 mmol/L. These are reflecting an improvement in glucose hemostasis pot the intervention. Moreover, the mean glucose concentration at 120 min post-test manifested 47.2% reduction in post S12 compare to the baseline. While the reduction in the mean glucose concentration at 120 min in Post 1st Exercise was 14.9% compared to the bassline. In

addition, glucose-response curve shapes during OGTTs exhibited monophasic response at baseline post S1 and post S12. As the graph showed, the initial increase in glucose concentration until reached the peak before it started to decline post 90 min without a secondary increase with a difference in glucose level between 90 and 12 min above 0 value [6]. The graph showed a reduction in the OGTT area under the curve (AUC) for glucose Post 1st Exercise and Post S12 were 7.6% and 12.8% respectively compared to the baseline.

Conclusion

In this investigation, the first aim was to examined the effects of a combined exercise programme AE and RE on improving insulin resistance among Pre-D. The result of this study has shown that 6 weeks of moderate-intensity exercise combined with aerobic and resistance exercise program had significantly ameliorate insulin resistance among Pre-D. It may be that these participants benefitted from perform these trainings under the supervision of an expert in exercise in order to maintain the improvement in insulin sensitivity.

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