



Case Study of Single Bout Resisted Exercises of Arms Versus Legs on PPBG in a Type II Diabetic Subject

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Abstract

Impact of single bout of resisted exercises using Physioball on post prandial blood sugar demonstrated on the same subject on two different days; first session was exercises for both upper extremities alone, second session with a days gap on the same subject where exercises to both lower extremities were performed. Results of post prandial blood lowering has shown with double the reduction with upper extremity exercises than leg exercises.

Keywords: PPBG: Post prandial Blood Glucose, ADA: American Diabetic Association, ACSM: American College of Sports Medicine

Introduction

Insulin mediated glucose clearance is diminished in type II diabetes. Arterio venous glucose extraction was higher in arm than legs (Oslen etal 2005). Exercises of moderate intensity have shown to decrease plasma glucose concentrations in the post absorptive state (Martin etal 1995). ADA and ACSM have evidenced the benefits of resisted exercises in type II diabetes (Williams etal 2007).

Objective of the Study

To evaluate single bout of resisted exercises on arm versus legs in lowering PPBG on the same subject on two different days. This study is an innovative and first of its kind to analyse region

specific effects of exercises among type II diabetic.

Ms.XXX, Aged 46 years

Height: 156 Cm, BMI: 33 Kg/Cm²

Weight: 80Kg , Waist Circumference: 98 Cm

Background Information

A commerce graduate and mother of two adolescent, regularly menstruating, physically active women with walking for ½ hour 5 times weekly attending the center for obesity and diabetic management with physical means.

H/O – Endomorph, Family h/o with Mother was a diabetic, is on T. Amlong and T. Glycomet.

O/E – Both knee joints extreme flexion restricted and knee movement painful limiting long sitting / standing / exertional activities.

- Other peripheral joints full and free.
- No motor deficit recorded.
- Exercise tolerance was good as noted from tread mill test, she has undergone a week before.

Single bout of resisted exercises lowering post prandial blood sugar was carried out on this subject earlier, then arised hypothesis of regional exercises benefits on glycemic control, hence

resisted exercises only for upper extremities were analysed versus resisted exercises for lower extremities using Physioball as the tool with single boot of exercises on post prandial blood sugar using omron digital glucometer was carried on two different dates of the same week at same time. While the subject had vegetarian lunch at 01.30 P.M on both days.

28-03-2016: 04.00P.M

Table: 1 Results of resisted exercises for both upper extremities.

	HR/ minute	Intensity of exercises	BP mm / hg	PP/ mg	% of PP Lowered
Pre	82		142 /83		
Post	136		134 - 81		
Pre				150	
Post		81% of maximum heart rate		132	12%

10 sets of five repetition for a duration of 25 minutes

30-03-2016: 04.00P.M

Table: 1 Results of resisted exercises to both lower extremities

	HR/ minute	Intensity of exercises	BP mm / hg	PP/ mg	% of PP Lowered
Pre	82		140 /89	160	
Post	140		125 - 82	152	
Pre				150	
Post		80% of maximum heart rate		132	5%

10 sets of 5 repetition for a duration of 25 minutes

Sweating was profuse with both sessions while doing exercises

Discussion

Reduction of PPBS among upper extremity exercises (12%) is double that of lower extremity exercises (5%) as inferred from table 1& 2. This study findings are supported by 15% reduction in PPBS using combined arm and leg exercises with resisted means using Physioball (Subramanian 2016). Post prandial high intensity exercise does

not deteriorate glucose homeostasis but reduces the glucose concentration and insulin secretion (Larsen etal 1999). Acute physical exercise reverses obesity induced TLR 4 activation and insulin signaling in obese as demonstrated on rates (Alexandre etal 2010). Single bout of muscle contraction leads to a translocation of GLUT 4 to the sarcolemmal membrane, which acutely

enhances glucose transport capacity (Kennedy et al 1994). Exercise increases muscle blood flow, recruitment of muscle capillaries and glucose transporters by an increase in muscle metabolic rate and by increasing insulin sensitivity (Dela et al 1994).

The present findings raise the question of why the arm and leg muscles are different in glucose clearance and why insulin resistance is less pronounced in the arm muscles in type II diabetes. The following studies could be the supportive evidence to the outcome of the case study:

- Skeletal muscle, which makes up 40% of body mass is the major tissue involved in glucose metabolism and an important site of insulin resistance in obesity and type II diabetes (DeFronzo et al 1992).
- Glucose transport and uptake are diminished in skeletal muscle in type II diabetes (Dela 1995). The reduced muscle glucose uptake has been estimated to account for 55% (Basu et al 2000).
- The possibility exists that there is a difference in glucose uptake between muscles, as glucose uptake capacity is larger in red oxidative than in white glycolytic fibres (Good Year et al 1991).
- Muscle fibre type composition, contribute to a difference in insulin sensitivity between arm and leg muscles (Shantz et al 1983).
- Reports have shown that the same tissues at different areas are not metabolically equal (Enevoldsen et al 2001).
- In type II diabetes density of GLUT4 has been shown to be higher in fast muscle fibres compared with slow fibres (Gaster et al 2001). Given a higher proportion of fast type II muscle fibres in the upper body, could have explained the preserved glucose uptake.
- Glucose clearance is higher in arm than leg muscle in type II diabetes (Olsen DB 2005).
- Impaired insulin – stimulated muscle glucose uptake (MGU) is a hallmark of type II diabetes (DeFronzo et al 1992) and reduced MGU has been consistently shown in studies using arterio – venous differences across the leg (Dela et al 1995); however studies using the forearm arterio venous balance technique, reduced glucose uptake has been less consistent (Avagaro et al 1997; Blaak & Wagenmakers 2002). Arm blood flow was higher than leg blood flow proven with Doppler ultra sound (Huonker et al 2003) and insulin sensitivity in the arm muscle in type II diabetes which further research is recommended.
- Another possible explanation for the difference in arm and leg insulin sensitivity found could result from differences in vascular responsiveness between upper and lower limbs. Newcomers et al 2004 have demonstrated that arm vasodilator response compared to the legs is higher to both pharmacological and physiological vasodilator stimuli.
- Also the development of atherosclerosis in lower limb is common and severe (Bucciarrelli et al 2002) and not seen in the arms (Sorensen et al 1997).

Limitations and Recommendation

This case study finding though novel, region specific impact on exercises in diabetic requires further validation with larger sample size, male subjects, longer follow up as well with other parameters such as fasting blood sugar for single bout of resisted exercises among type II diabetic subjects.

Conclusion

Major findings of this case study are that glucose clearance is higher in arm than legs. Lowering of blood glucose with exercises with every session and its cumulative impact on long term diabetic management especially with resisted means

induces confidence among the subject and the therapist. Influence of muscle and region specific exercises on glucose clearance among diabetic individual necessitates stronger scientific researchers in future.

Acknowledgment

Chennai Geriatric Centre, Chennai – 20

Subject who was involved in this study

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