HIGH INTENSITY RESISTED EXERCISES ON BLOOD GLUCOSE PROFILE AND MUSCLE GIRTH – NEW DIMENSION IN DIABETIC CARE WITH PHYSIOTHERAPY

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ABSTRACT

An increase in the global diabetic prevalence, obesity, care with physiotherapy, in these subjects needs to be studied more. With effects of various means of exercises on diabetic care a lot further to be analyzed. Aims & Objectives of this original research was a) To analyze high intensity resisted exercises (RE) on glycemic control b) to find muscle circumference changes with RE and its effect on glycemic control. Materials & Methodology: 62 Year old type II diabetic Male on insulin therapy was treated with specific resisted exercises with twice a week frequency at Chennai from 23.12.2017 to 24.12.2018. Pre and Post biceps brachii, deltoid, quadriceps, gastronomies muscle circumference, blood sugar profile, were evaluated, recorded and analyzed statistically. Results An improved of muscle circumference and blood sugar profile showing statistical values at P<.05. Conclusion: This innovative means of resisted exercises on muscle morphology will forms the need to compare effects of various modes of physical exercises means on diabetic care.


INTRODUCTION

1. 415 million globally suffering from (Diabetic Mellitus) DM (IDF 2015) and Indian diabetic prevalence was 7.3% (Anjana etal 2011).
2. Risk factors such as ageing, male, gender, smoking, low level of physical activity, high cholesterol, hypertension and duration of diabetes over 10 years are proven predictive factors for micro vascular complications (Chilelli et al 2013), Such as diabetic neuropathy, nephropathy and retinopathy (Nguyen et al 2012).


4. Macro vascular complications such as athero sclerosis among 20-65 years with diabetic mellitus is 5 times than non diabetics (Khoury et al 2013).

Resistance exercise training (RET) enhances insulin sensitivity, QOL (Quality of Life), increasing muscle strength (Quellete et al 2004) lean muscle mass (Ryan et al 2015), bone mineral density Enhance glycemic control, prevention of sarcopenia and osteoporosis (Hurley et al 2000). In 5 months recorded lowering of low density cholesterol, triglycerides with. 4% reduction in hba1c with RET(Hankola et al 1997 & Erikson et al 1997).

Lack of time is a common reason why many people don’t adhere to traditional training programs, metabolic related disorders arising secondary to a sedentary life style have become a large and expanding health problem in present (Booth & Winder 2012). Thus short term high intensity interval training with time efficient strategy for health promotion (Gibala 2007) substantially improving insulin action (Babraj et al 2009) cardio respiratory fitness (Burgomaster et al 2008) and skeletal muscle oxidative capacity similar to prolonged training (Gibala et al 2006). This original research aims to analyse the impact of the year of high intensity resisted training on blood glucose profile and muscle mass.

**Back Ground Information**

**Aims & Objectives of this original research was**

a. To analyse the impact of high intensity resisted exercises on blood sugar profile

b. To evaluate muscle circumference with resisted exercises and its influence on glycemic control

Mr. XXX, 61 years old male an engineer, vegetarian, known type II diabetic on medication for 30 years with his both parents were diabetic. Since 2010, he was on 20 units of lantus insulin therapy, with sedentary life style.
MATERIALS AND METHODOLOGY
This original research was conducted in Chennai during the period from 23.12.2017 to 24.12.2018. The subject was treated with non pharmacological intervention, using 12 specific core exercises with 5 repetitions using Physioball as a tool of resisted exercises, but he has continued with his physical daily activities and insulin therapy as prescribed by his diabetologist. He was able to tolerate an exercise intensity of 60-80% of MHR (Maximal Heart Rate) which was increased gradually.

RESULTS AND CLINICAL PROGNOSIS
Generalized sweating were recorded, no hypoglycemic spells were noted. With a frequency of twice a week. Pre and post FBS, PPBG, hba1c, and muscle circumference of biceps brachii, deltoid, quadriceps and gastrocnemius, were evaluated, recorded and analyzed with statistical means in the following ways:

**Keywords:** HbA1C – Glycosylated Hemoglobin, FBS – Fasting Blood Sugar, PPBS – Post prandial Blood Sugar Muscle Circumference, Hypoglycemia, QOL – Quality of Life, IDF – International Diabetes Federation.

**Subjective impact on treatment with RET over his quality of life**
He has given a feed back of an increased energy level for daily activities, started walking regularly, was confident to improve hba1c, and wishing to continue anti diabetic tablets instead of insulin therapy with his diabetologist’s advice, in response to RET.

**Table 1: Results of paired ‘t’ test of FBS, PPBS and hba1c.**

<table>
<thead>
<tr>
<th></th>
<th>FBS</th>
<th>PPBS</th>
<th>hba1c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre mg</td>
<td>145</td>
<td>203</td>
<td>9%</td>
</tr>
<tr>
<td>Post mg</td>
<td>115</td>
<td>192</td>
<td>8%</td>
</tr>
<tr>
<td>SD</td>
<td>18</td>
<td>9.42</td>
<td>.82</td>
</tr>
<tr>
<td>SE</td>
<td>9.49</td>
<td>3.13</td>
<td>.47</td>
</tr>
<tr>
<td>t</td>
<td>3.16</td>
<td>3.51</td>
<td>2.13</td>
</tr>
<tr>
<td>p</td>
<td>&lt;.05</td>
<td>&lt;.05</td>
<td>&lt;.05</td>
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</tbody>
</table>
Table 2: Results of Pre and Post Muscle Circumference Changes in response to RET.

<table>
<thead>
<tr>
<th>Biceps Cm Brachii</th>
<th>Deltoid Cm</th>
<th>Quadriceps Femoris Cm</th>
<th>Gastronomies Cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre 30</td>
<td>Post 32</td>
<td>Pre 32</td>
<td>Post 35</td>
</tr>
<tr>
<td>Increased 2 Cm</td>
<td>Increased 3 Cm</td>
<td>Increased 2 Cm</td>
<td>Increased 3 Cm</td>
</tr>
</tbody>
</table>

Foot Note

Muscle circumference with reference points used to measure are:

I. Biceps brachii 3” above elbow
II. Deltoid – 1” below Acromion process
III. Quadriceps femoris 1” above petalla supervise order
IV. Gastrocnemius 3” below tebial tubercle (Kim etal 1997)

Also Note

As inferred from the above table: 2 increased in upper extremity muscles are from 2-3 cm, whereas lower extremity muscles have shown an increase of 1 cm with RET.

Key clinical outcome of this research findings

1. Muscle hypertrophying more with arm muscles than leg muscles
2. Improved blood glucose profile
3. An improved subjects QOL
4. Leg muscles responds better with resisted exercises than arms was supported by (Subramanian etal 2017)

➢ Further research in continuation of this findings where using ultrasound investigations morphological changes in muscular tissue, enzyme changes could validate more

DISCUSSION

Critical Analysis of this Research Findings

i. Only mechanism of muscle mass gained was supported with evidence and cross sectional area with motor, units action potential with exercises were not analyzed using EMG
ii. Only one mode with resisted exercises was studied here
iii. Outcome measures were only on blood sugar profile and not on their quality of life of the subject was presented here
iv. The effects of insulin therapy, other daily physical routines, diet were not controlled in this study.

**Possible Mechanism behind this Research**

a) Strength training with an intention to develop strength and induce muscle hypertrophy (Knuttgen et al. 2007) and an increased lean body mass may increase the basal energy expenditure and favor the loss of body fat (Steigler et al. 2006) with a potential stimulus for osteogenesis increased bone mass and bone mineral density may increase bone strength, which is of interest in prevention of osteoporosis later in life as high intensity interval training have an impact on bone mineral density (Rector et al. 2009) increased insulin action in skeletal muscles among type II diabetic subjects (Holten et al. 2004). Increase in skeletal mass are related to decrease in hba1c (Baldi et al. 2003, Castenda et al. 2002). Supports the hypothesis that resistance training improves glycemic control by augmenting skeletal muscle storage of glucose. But it is not explained with qualitative improvements in skeletal muscle as even without change in lean body mass insulin sensitivity improves with resisted training (Ishi et al. 1998). But as inferred from results table 2 increased muscle girth were more in arm muscles than leg muscles which an improved glycemic control which is supported by (Subramanian et al. 2017).

b) While 12 week of interval training among normal subjects have no impact on muscles mass or leg bone mass among 36 untrained subjects in a Denmark based research by (Nybo et al. 2010). Castenda et al. 2002 in a RCT with high intensity resistance training among 62 older adults with 1% decrease in hba1c while muscle glycogen storage increased by 31% compared with reduction of muscle glycogen by 23%, reduction in systolic blood pressure, increase in mean lean issue mass of 1.2 Kg and a reduction of diabetic medication among 72% versus 3% among control group. Baldi et al. 2003 have in a RCT with moderate intensity exercises. 5% reduction in hba1c, 3.5% increase in fat free mass in resistance group versus 6.9% increase in control group. Thus influencing on muscle hypertrophy and glycemic control. Holten et al. 2004 have among diabetic with one legged resistance training enhanced insulin action in skeletal muscle independent of increase in muscle mass. Tae Jung Oh 2019 muscle strength muscle strength was lower in men with DPN (Diabetic Peripheral Neuropathy) among 230 diabetic, hand grip strength was measured and low in men with DPN than without DPN prevention of sarcopenia was recommended. Mairona et al. 2003 combined 8 weeks aerobic and resisted exercises
among 16 of 52 years mean age diabetic subjects has found lowering of glycemic control, FBS, heart rate, waist hip ratio and an increased lean body mass, muscle strength. As displayed in table 1 and 2 along with an improved subjective feedback an increased energy levels and confidence in improving the quality of life were working recording here and a major outcome of this research.

Where the effect of RBS using RE in a cross over study of arm exercises versus leg exercises in a diabetic subject were recorded with double lowering among leg exercises than arm exercises. Eves et al. 2006 among diabetic subjects using moderate intensity resistance exercises improves in 3 months by, 6%

a) Researches Favoring Outcome of this Research

Among diabetic and obese subjects high intensity training is more effective than moderate intensity exercises (Schjerve et al. 2008). Dunstan et al. 1998, RCT have recorded with moderate resistance training a reduction in blood glucose. Ishi et al. 1998 using hyper insulin euglycemic clamp, glucose disposal rate with moderate intensity resistance training in 4-6 weeks. Sigal et al. 2004 have recommended resistance exercises weekly thrice for major muscle groups 8-10 repetitions. ADA with two RCTS (Castenda et al. 2002 & Dustan et al. 2002) with RE an improved hba1c. 0.6% reduction of hba1c can reduce micro vascular complications by 32% (Plotnikoff et al. 2006) and with 3 RCTS (Baldi et al. 2003, Castenda et al. 2002, Dustan et al. 2002) mean .9% reduction of hba1c, 48% reduction of micro vascular complications. Hence as shown results table this subject with reduction of hba1c by 1% has benefited more than 60% against micro vascular complications and 50% protected against macro vascular complications.

Limitations of this research were single subject was included in this experimental design, other lifestyle parameters were not studied.

CONCLUSION

Role of physiotherapy should not only eyed on aerobic exercises, resisted exercises alone but the impact of exercises on musculoskeletal ailments associated with diabetes, prevention of diabetes among pre diabetic subjects, control of obesity and evaluate the impact of strength and muscle mass gain as analyzed in this presentation. However this research findings needs larger sample size, other measurable parameters such as EMG, muscle cross sectional studies to validate more scientifically.
REFERENCES


