PROGRESSIVE RESISTED EXERCISE IN TYPE 2 DIABETES

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Progressive Resistance Exercise improves glycaemic control in people with type 2 Diabetes mellitus: A Systematic Review

Casey Irvine and Nicholas Taylor

Australian Journal of Physiotherapy 2009 55:237-246

- Defective insulin secretion
- Defective insulin production

- Chronic elevated plasma glucose

- Retinopathy, Neuropathy,
- Nephropathy & Risk of CVD

HbA1c- Glycated Heamoglobin

- Plasma glucose concentration
- Gold standard to monitor long term DM (2-3 Months)
- Existing reporting: Ideally : Less than 7% (Diabetes Control and Complications Trial)
- Newer reporting from 2009: International Federation of Clinical Chemistry (IFCC) units: Less than 53 mmol/mol

Review Questions

- Does PRE improve glycaemic control in DM more than aerobic or no exercise?
- Does it improve strength and body composition?
- Is it safe?

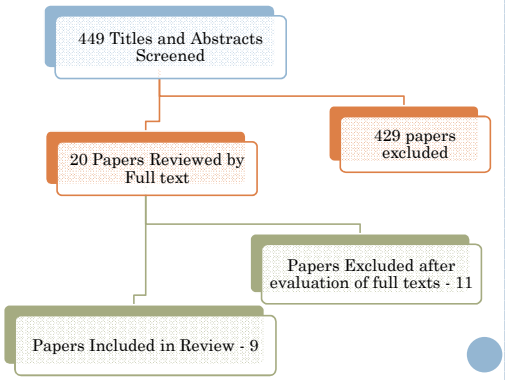
ACSM Progressive Resistance Exercise

- 2-3 times a week
- 1-3 sets of 8-12 repetitions
- Starting with 45-50% of 1RM progressing to 70-80% of 1Rm
- 1RM- amount of weight that can be lifted JUST once through available range

Inclusion Criteria

- RCT, Peer reviewed papers, PEDro Scale
- Type 2 DM
- Human
- PRE
- Exercise duration more than 8 weeks
- Outcome measure: HbA1c
  Body Composition
- Comparisons : PRE vs no Exercise
  PRE vs Aerobic Exercise

1. eligibility criteria were specified — no ❑ yes ❑ where:
2. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received) — no ❑ yes ❑ where:
3. allocation was concealed — no ❑ yes ❑ where:
4. the groups were similar at baseline regarding the most important prognostic indicators — no ❑ yes ❑ where:
5. there was blinding of all subjects — no ❑ yes ❑ where:
6. there was blinding of all therapists who administered the therapy — no ❑ yes ❑ where:
7. there was blinding of all assessors who measured at least one key outcome — no ❑ yes ❑ where:
8. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups — no ❑ yes ❑ where:
9. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat" — no ❑ yes ❑ where:
10. the results of between-group statistical comparisons are reported for at least one key outcome — no ❑ yes ❑ where:
11. the study provides both point measures and measures of variability for at least one key outcome — no ❑ yes ❑ where:



Characteristics of studies included

- Quality: 3-8, avg of 5
- 372 participants, 192 completed PRE
- 66% Males
- Average Age: 58.4 Yrs (46.5 – 67.6 Yrs)
- Mean BMI: 32 $Kg.m^{-2}$
- Duration of DM: 7.2 Yrs (4.8 – 9 yrs)
- Baseline HbA1c: 7.9%
- Duration of Ex Prog: 19.8 Wks (8-26 wks), 3 times a week, 45-50 minutes/session,

- Exercises were supervised
- Weights and weight machines were used
- 2-3 sets of 8-15 reps of 5-10 Exs
- Outcomes Measured:
  - HbA1c
  - Strength,
  - Lean Body Mass,
  - Fat Free Mass

Analysis

- Hedges g – Standard Mean Difference
- RevMan Ver 5.0 – Cochrane Collaboration

Results

HbA1c

- In non ex trials (7): Reduction by 0.3%
- Vs Aerobic Ex (3): No significant reduction

Strength

- Non Ex trials (4) : Avg increase of 35% (large and significant)
- Vs Aerobic Ex (2): Significant Increase

Body Composition

- Vs No Ex (4): No Significant effect
- Vs Aerobic Ex (3): No significantt effect

Safety

- Recording was done in 8/9 trials
- 7/8 trials- no exercise related injuries
- Delayed Onset Muscle Soreness commonest reported problem.

DISCUSSION

- Participants who completed PRE made a 55% improvement towards the target 7% of HbA1c
- Although small, the reduction may be clinically significant
- PRE should not be the stand alone treatment
- PRE is better than not exercising at all, but is not significantly better than aerobic exercises
- PRE can be effective when performed only on 3 days a week, compliance rates- 87%

- Sigal (2007), shows combined approach better than PRE and aerobic ex alone
- Improvements were seen in strength, no increase in LBM and Fat free mass- efficency of glucose disposal without change in muscle morphology

Clinical implications

- 1% Reduction in HbA1c causes
  - 37% decrease in risk of microvascular complications
  - 21% decrease in mortality assoc with diabetes
- Easily reproducible, low cost settings
- Can be supervised by physio

Research questions

- Will longer trials influence muscle morphology & will it affect Glycemic control?
- What is minimum duration of programme, minimum frequency of sessions, minimum duration of each session?
- Determine additive benefits of PRE + Aerobic Ex

STRENGTHS	LIMITATIONS
Follows QUOROM checklist for high quality reporting of systematic reviews.	Conclusions rely on included trials
Includes recent and relevant trials	Lack of long term follow up
Clinically applicable as population was below 40 yrs diabetics, males	Title misleading
Replicable interventions – low cost settings, readily available equipments, supervised by physios	PRE protocols were different
	Physiological basis not clear

Effect of supervised progressive resistance-exercise training protocol on insulin sensitivity, glycemia, lipids, and body composition in Asian Indians with type 2 diabetes

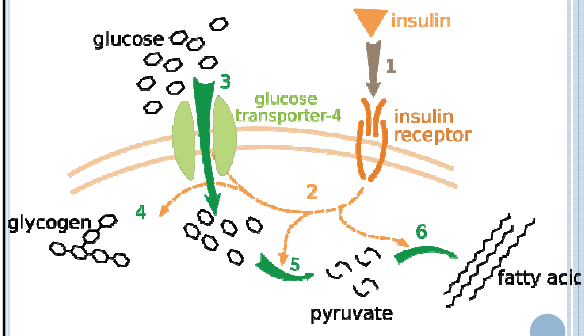
Anoop Misra et.al,

Diabetes Care 31:1282–1287, 2008

- 30 patients, 12 week PRE prog
- 2 sets of 10 reps each
- Outcomes: HbA1c, FBS,TC,Tg,
- Improvements seen in HbA1c 0.54% lipids,

Physiological basis

- Exercise causes increase in GLUT4 in skeletal muscles (insulin-regulated glucose transporter found in adipose tissues, skeletal and cardiac muscle that is responsible for insulin-regulated glucose translocation into the cell)
- Resistance ex increases fat free mass leading to increased glucose disposal
- Aerobic training enhances glucose disposal independent of changes in fat-free mass, fat mass, or maximum aerobic capacity, bringing about functional changes in the muscle



HYPOTHESIS

As skeletal muscle is the principle area of glucose disposal, increasing muscle bulk would increase insulin sensitivity, perhaps due to improved muscle physiology and vascularity.

But they did not observe any change in lean body mass and cross-sectional area of skeletal muscles of upper arm and thigh.


THANK YOU