



PILOT STUDY OF AN INTENSE HEALTH PROMOTION PROGRAM ON OLDER ADULTS WITH TYPE 2 DIABETES

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BACKGROUND

Diabetes is a leading cause of adult disability in the United States.¹ Although it is well-established that lifestyle changes including healthy diet and exercise can significantly reduce the prevalence of diabetes and complications,²⁻⁶ there is a critical gap in knowledge regarding the outcome of comprehensive health promotion programs in people with diabetes.

Several small studies have demonstrated improved glycemic control following aerobic and resistance exercise in people with diabetes.^{7,8,9,10} However, none of these studies included both aerobic and resistance training at the frequency (3-5 days per week) recommended by ACSM for individuals with type 2 diabetes for weight reduction and improved health.¹¹ Dietary interventions are an important part of diabetes management, and consistently have been found to reduce weight and improve glucose control in people with diabetes.¹²⁻¹⁴

Although "lifestyle change" would seem to imply both diet and exercise interventions, previous studies of people with diabetes have not adequately combined supervised exercise with diet counseling and education.^{7,8,15} The large Diabetes Prevention Program (DPP) trial had excellent outcomes for subjects at risk for diabetes that were assigned to an intensive lifestyle intervention group.¹³ The 16-lesson curriculum covered diet, exercise, and behavior modification over a 24-week period. However, subjects with a diagnosis of diabetes with potential complications may have difficulty with the recommendation of 150 minutes per week of "brisk walking" as recommended in the DPP trial; in fact, it could be contraindicated in subjects with neuropathy.

The outcome of health promotion interventions that incorporate intense, supervised exercise with customized dietary information and education for people with diabetes are absent from the literature.

PURPOSE STATEMENT

The purpose of this pilot study was to assess the effect of an intense health promotion program on glycemic control and aerobic fitness in older adults with diabetes.

Figure 1. Exercise equipment available



METHODS

Subjects: To be enrolled in the study, subjects had to be diagnosed with type 2 diabetes, age 40-70 years old, and receive documentation from their physician that they were medically stable to participate in a supervised exercise program. Exclusion criteria included:

- Serious, symptomatic cardiac, pulmonary, musculoskeletal, or CNS pathology
- Current active involvement in a regular (≥ 3 times per week) exercise program
- Open wounds on the weight bearing surface of the feet
- Not able to ambulate independently

Outcomes:

Glycemic Control. Glycosolated hemoglobin (HbA1c) was assessed with a fingerstick blood test using a disposable HbA1c analyzer (A1CNow+, Metrika). The test gives an indication of the level of glycemic control over a 3-month period.

Aerobic Fitness. A graded maximal exercise test was performed to measure peak oxygen consumption, using an integrated metabolic cart (Parvo Medics TrueOne 2400) with ECG. A maximal exercise test is indicated for people with diabetes prior to exercise due to the high prevalence of undiagnosed autonomic neuropathy.^{16,17} A standard test protocol using the a cycle ergometer was performed:¹⁸ subjects began cycling at 50 rpm with 0 Watts (W) for the first 3 minutes, and the workload was increased by 10 W every minute. Tests were continued until maximal effort was achieved (age-predicted maximal heart rate, respiratory exchange ratio (RER) > 1.1, plateau response) or voluntary termination secondary to exhaustion.

Secondary Outcomes: Body mass index (BMI), self-efficacy, and symptoms of neuropathy were also assessed.

Intervention: The 10-week program (Table 1) was implemented with small cohorts of subjects to promote the development of a supportive network within the group members.

Exercise Component. The exercise intervention was supervised by health professionals or students with current CPR certification. The VO_{2peak} values were used to calculate a moderate level of intensity for the aerobic program, and a 10-repetition maximum weight was established. Each exercise session included stretching to warm up and relaxation activities to cool down. A variety of cardiovascular training equipment was available (Figure 2), and strength training included: abdominal curl, biceps curl, chest press, lat pulldown, leg extension, seated leg curl, seated row, shoulder press, squat, and triceps press. Blood glucose level, blood pressure, heart rate, and rate of perceived exertion (RPE) were monitored during each session.

Educational and Nutrition Components: Materials from the National Diabetes Educational Program (<http://www.ndep.nih.gov>) were provided, and a registered dietitian modeled the nutrition sessions after the DPP curriculum with the overall goals of decreasing fat intake and increasing consumption of fruits, vegetables, and whole grains.¹³

Data Analysis: Descriptive statistics of the outcome measures were calculated, and a paired t test was used to detect changes ($\alpha=0.05$).

Table 1. Description of Intervention

	# sessions	Total aerobic time (min) and intensity (%VO ₂ R)	Total strength training repetitions	Education session	Nutrition session
Week 1	3	40 @ 50%	10 reps	Setting goals	Diabetes Food Pyramid
Week 2	3	30 @ 50%	20 reps	Monitoring ABC's of diabetes	Self-monitoring diet intake
Week 3	3	60 @ 50%	10 reps	Healthy and happy feet	Modify favorite recipes
Week 4	4	60 @ 50%	20 reps	Risk factors for stroke and CVD	Taste test new items
Week 5	4	60 @ 60%	20 reps	Family support day	Be a fat detective
Week 6	4	60 @ 60%	30 reps	Stress management	Healthy snacks
Week 7	4	80 @ 60%	30 reps	Accessing health information	Four keys to eating out
Week 8	4	80 @ 60%	30 reps	Preventing depression	Modify favorite recipes
Week 9	4	80 @ 70%	30 reps	Building healthy relationships	Taste test new items
Week 10	4	100 @ 70%	30 reps	Graduation ceremony	Review goals



RESULTS

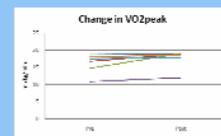
Six subjects with type 2 diabetes (2 males/4 females, all Caucasian, age 60.2±4.7) completed this pilot study. At entry into the study, the subjects had poor aerobic fitness (VO_{2peak} 15.5±3.3 ml/kg/min) and well-controlled blood glucose (glycosolated hemoglobin or A1C 6.7±0.6%). They were obese (BMI 33.8±7 kg/m²) with mild symptoms of neuropathy (pain scale 17 out of 38 ±5.6; Michigan Neuropathy Screening Instrument or MNSI 3.5 out of 10 ±1.4), and self-efficacy for diabetes scores of 59±8.4 (out of 80).

The primary outcome results are illustrated in Figures 2 and 3: significant improvements in A1C (mean change -0.53±0.5%, $p=0.03$), VO_{2peak} (mean change 1.38±1.7 ml/kg/min, $p=0.05$), pain (-4.2±4.1, $p=0.03$), and self-efficacy (15 ±12.2, $p=0.02$) were noted, with small changes in BMI that did not reach significance (-0.94±1.3 kg/m², $p=0.07$).

Figure 2. Glycemic control results



Figure 3. Aerobic fitness results



CONCLUSIONS

Following participation in this pilot health promotion program, subjects had meaningful improvements in glycemic control with lower A1C levels, increased aerobic fitness, decreased pain, and improved self-efficacy. The results of this pilot study illustrate the need for physical therapists to become more involved in prescribing and implementing exercise and health promotion programs for older adults with diabetes

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