

Aerobic plus resistance training was more effective than either alone in type 2 diabetes

STUDY DESIGN

Design: randomised controlled trial (Diabetes Aerobic and Resistance Exercise [DARE] trial).

Allocation: concealed.*

Blinding: blinded (data collectors† and outcome assessors)*.

STUDY QUESTION

Setting: 8 community-based exercise facilities in the Ottawa-Gatineau region, Canada.

Participants: 251 participants 39–70 years of age (mean age 54 y, 64% men) who had type 2 diabetes for >6 months, had baseline HbA_{1c} levels of 6.6–9.9%, were previously inactive, and attended 10–12 exercise sessions in a 4-week run-in phase. Exclusion criteria included insulin therapy; ≥20 min/session of exercise ≥2 times/week or resistance training in the past 6 months; changes in antihypertensive, lipid-lowering, or oral hypoglycaemic medication; ≥5% change in body weight in the past 2 months; proteinuria >1 g/day; serum creatinine level ≥200 μmol/l; and blood pressure (BP) >160/95 mm Hg.

Intervention: aerobic training (n = 60), resistance training (n = 64), aerobic plus resistance training (n = 64), or no exercise (n = 63). All 3 exercise groups received supervised training 3 times/week for 22 weeks, with gradual progression in duration and intensity. Aerobic training consisted of exercises on treadmills or bicycle ergometers and progressed from 15–20 min/session at 60% maximum heart rate to 45 min/session at 75% maximum heart rate. Resistance training consisted of 7 different exercises per session using weight

machines, and each exercise progressed to 2–3 sets at maximum weight lifted 7–9 times.

Outcomes: included changes in HbA_{1c} level, body weight, waist circumference, BP, and lipid levels.

Follow-up period: 6 months.

Patient follow-up: 88% (intention-to-treat analysis).

MAIN RESULTS

The table shows the results. Resistance training and no exercise did not differ; combined training did not differ from aerobic or resistance training. Groups did not differ for changes in BP or triglyceride, HDL, non-HDL, or LDL cholesterol concentrations.

CONCLUSION

Combined aerobic and resistance training was more effective than either alone for reducing haemoglobin A_{1c} concentrations in type 2 diabetes.

*See glossary.

†Information provided by author.

Abstract and commentary also appear in *ACP Journal Club*.

ABSTRACTED FROM

Sigal RJ, Kenny GP, Boule NG, et al. Effects of aerobic training, resistance training, or both on glycaemic control in type 2 diabetes: a randomized trial. *Ann Intern Med* 2007;**147**:357–69.

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► **Clinical impact ratings:** GP/FP Primary care 6/7; IM/Ambulatory care 5/7; Endocrine 5/7; Physical medicine & rehabilitation 5/7

Comparisons of aerobic training, resistance training, combined training, and no exercise for type 2 diabetes*

Outcomes at 6 months	Mean change from baseline				Difference in change between groups (95% CI)
	Combined	Aerobic	Resistance	No exercise	
HbA _{1c} concentration (%)	—	−0.43	—	0.07	−0.51 (−0.87 to −0.14)
	—	—	−0.30	0.07	−0.38 (−0.72 to −0.22)
	−0.90	−0.43	—	—	−0.46 (−0.83 to −0.09)
	−0.90	—	−0.30	—	−0.59 (−0.95 to −0.23)
Body weight (kg)	—	−2.6	—	−0.3	−2.2 (−3.9 to −0.6)
Waist circumference (cm)	—	−3.0	—	−1.0	−2.1 (−4.1 to −0.2)

*Hb = haemoglobin; CI defined in glossary. Analysis based on a mixed-effects model and adjusted for age, sex, training site, and hypoglycaemic medication.

Optimal management of type 2 diabetes includes exercise. The American Diabetes Association¹ recommends 150 min/week of aerobic and resistance exercise. However, this recommendation does not address the issue of the incremental effect of combined aerobic and resistance exercises.

This well-designed study by Sigal *et al* is an important contribution to the knowledge base on the incremental effects of combined aerobic and resistance exercise for glycaemic control in type 2 diabetes. It overcame some of the challenges faced by behaviour modification studies; however,

participants were motivated volunteers who were given the incentive of a free gym membership, which is difficult to achieve in routine practice.

Of note, the combined group exercised twice as much as the aerobic or resistance training groups alone; thus, it is difficult to know whether the difference in HbA_{1c} change between the groups is because of the duration or the combination of exercise. The incremental effect of combined exercise on body composition, lipids, and BP was not significant; however, aerobic exercise reduced waist circumference more than no exercise.

Clinicians can be more confident about giving specific advice about exercise, especially on the incremental effect of aerobic and resistance training on improving glycaemic control. The study also allows for estimation of the effect of exercise on glycaemic control and shows that this effect is greater in persons with higher HbA_{1c} concentrations.

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1. **Sigal RJ, Kenny GP, White RR, et al.** *Diabetes Care* 2006;**29**:1433–38.