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 HbA1c 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 = 65). 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 HbA1c 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 A1c concentrations in type 2 diabetes.

*See glossary.
†Information provided by author.
Abstract and commentary also appear in ACP Journal Club.

ABSTRACTED FROM

Correspondence to: Dr R J Sigal, University of Calgary, Calgary, Alberta, Canada; rsigal@ucalgary.ca
Source of funding: Canadian Institutes of Health Research and Canadian Diabetes Association.

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*

<table>
<thead>
<tr>
<th>Outcomes at 6 months</th>
<th>Combined</th>
<th>Aerobic</th>
<th>Resistance</th>
<th>No exercise</th>
<th>Difference in change between groups (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c concentration (%)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>0.07</td>
<td>−0.51 (−0.87 to −0.14)</td>
</tr>
<tr>
<td>−0.90</td>
<td>0.30</td>
<td></td>
<td></td>
<td>0.07</td>
<td>−0.38 (−0.72 to −0.03)</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>−2.6</td>
<td>−0.30</td>
<td>−0.30</td>
<td>−0.3</td>
<td>−0.46 (−0.83 to −0.08)</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>−3.0</td>
<td>−1.0</td>
<td>−1.0</td>
<td>−2.1</td>
<td>−2.0 (−4.1 to −0.2)</td>
</tr>
</tbody>
</table>

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