Review: Exercise training reduces HbA_{1c} levels but not body mass in type 2 diabetes mellitus

Boulé NG, Haddad E, Kenny GP, Wells GA, Sigal RJ. **Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus. A meta-analysis of controlled clinical trials.** JAMA. 2001 Sep 12;286:1218-27.

QUESTION

In patients with type 2 diabetes mellitus, does exercise training improve glycemic control (reduce glycosylated hemoglobin [HbA_{1c}] levels) and reduce body mass?

DATA SOURCES

Studies in all languages were identified by searching MEDLINE (1966 to 2000), EMBASE/Excerpta Medica (1980 to 2000), SPORT DISCUSS (1949 to 2000), HealthSTAR (1975 to 2000), Dissertation Abstracts (1861 to 2000), and the Cochrane Controlled Trials Register; by checking the reference lists of major textbooks, review articles, and relevant articles from the search; and by contacting experts.

STUDY SELECTION

Studies were selected if they were randomized controlled trials (RCTs) or controlled clinical trials (CCTs) of exercise interventions lasting ≥ 8 weeks in patients with type 2 diabetes in whom compliance could be verified by direct supervision or diaries.

DATA EXTRACTION

2 investigators independently extracted data on sample size, baseline and post-treatment means and standard deviations of the intervention and control groups for HbA_{1c} levels and body mass, exercise-program characteristics (type, frequency, duration, intensity, and energy cost), and study quality (randomization, blinding, withdrawals, and concealment).

MAIN RESULTS

14 trials (11 RCTs) were included (504 patients, mean age 55 y, 50% men, mean duration of diabetes 4.6 y). The duration of the intervention ranged from 8 to 52 weeks (mean 18 wk). Study quality was moderate to low (mean score 1.6 out of 5 points). 12 trials that compared exercise with no exercise showed reduced HbA_{1c} levels with the exercise program ($P < 0.001$) (Table). 2 trials that compared diet plus exercise with no diet and no exercise also showed reduced HbA_{1c} levels with the intervention ($P = 0.008$) (Table). A sensitivity analysis showed no difference between results from RCTs and CCTs (Table). The results did not differ by type of exercise (aerobic vs resistance training). Exercise alone (12 trials, $P = 0.60$) or combined with diet (2 trials, $P = 0.24$) did not reduce body mass (Table). The results did not differ when RCTs, CCTs, aerobic training, or resistance training were analyzed separately. Meta-regression analysis showed that the reduction in HbA_{1c} levels could not be predicted by change in body mass, exercise intensity, or total amount of exercise.

CONCLUSION

In patients with type 2 diabetes mellitus, exercise training reduces HbA_{1c} levels but does not reduce body mass.

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Exercise vs no exercise for type 2 diabetes at mean 18 weeks*

Outcomes	Comparisons	Number of comparisons	Weighted mean difference (95% CI)
HbA_{1c} level (%)	Exercise vs no exercise	11	0.66 (0.34 to 0.98)
	Exercise + diet vs no exercise and no diet	3	0.76 (0.29 to 1.32)
	RCTs only (exercise and diet)	9	0.63 (0.25 to 1.01)
			Standardized mean difference (CI)
Body mass (kg)	Exercise vs no exercise	13	0.06 (–0.15 to 0.26)
	Exercise + diet vs no exercise and no diet	3	0.20 (–0.54 to 0.14)

*HbA_{1c} = glycosylated hemoglobin; RCTs = randomized controlled trials.

COMMENTARY

Exercise is widely recommended to patients with type 2 diabetes mellitus. Evidence for its effect on glycemic control, however, is scarce. Although patients enrolled in exercise programs obviously increase their energy output, they may compensate by spending less energy in other daily activities—a decrease in energy expenditure that is rarely accounted for in most studies (1, 2).

Without adjustment for overall energy expenditure and other factors associated with exercise, it is difficult to predict the independent effect of exercise interventions on body mass and glycemia, which also makes it difficult to provide specific recommendations to patients and practiance. The meta-analysis by Boulé and colleagues shows that three 45-minute moderate-intensity aerobic workouts per week (similar to the activity goals specified in the clinical guidelines for the treatment of obesity [3]) can reduce HbA_{1c} levels to a degree sufficient to reduce risk for myocardial infarction by 9% and microvascular complications by 24%, according to U.K. Prospective Diabetes Study Group data (4).

Many patients with diabetes do not have access to supervised exercise programs. Even among those who do have access, simple lifestyle changes (e.g., brisk walking daily) is more likely than supervised exercise to be sustained over the long term (5). This study does not address how to help patients sustain increased physical activity—a major challenge facing physicians and their patients with type 2 diabetes.

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