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The effects and physiological mechanisms of free-living interval-walking training on glycaemic control in type 2 diabetes patients: a randomised, controlled trial

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Background and aims: In type 2 diabetes patients, free-living walking training is feasible but shows limited effect upon glycaemic control variables. On the other hand, interval training methods have shown huge improvements in glycaemic control but suffer from lower adherence rates. In this study, we first evaluated the feasibility of free-living walking training in type 2 diabetes patients; secondly, we investigated the effects of interval-walking versus continuous-walking training upon glycaemic control; and thirdly, we assessed the underlying physiological mechanisms of changes in glycaemic control.

Materials and methods: Subjects with type 2 diabetes (58.7 ± 1.4 years, 29.5 ± 0.9 kg/m²) were randomized to a control group (n=8), a continuous-walking training group (n=12), or an interval-walking training group (n=12). Training groups were instructed to train 5 sessions per week, 60 minutes per session and were controlled with an accelerometer and a heart rate monitor. Before and after the 4 month intervention, maximal oxygen consumption (VO₂max) was assessed, glycaemic control was measured using continuous glucose monitoring (CGM), and insulin secretion/sensitivity was measured using a hyperglycaemic clamp (5.4 mmol/l above fasting glucose concentration).

Results: Training groups demonstrated high and equal training adherence ($89 \pm 4\%$), and training energy-expenditure and mean training intensity were comparable. VO₂max was unchanged in the control group and continuous-walking group, but increased in the interval-walking group ($16 \pm 4\%$, $P < 0.05$). Glycaemic control (mean CGM glucose levels) worsened in the control group (delta mean CGM glucose = 1.2 ± 0.4 mmol/l, $P < 0.05$), whereas mean and maximum CGM glucose levels decreased in the interval-walking training group (delta mean CGM glucose = -0.8 ± 0.3 mmol/l, $P = 0.05$, delta maximum CGM glucose = -2.8 ± 0.8 mmol/l, $P < 0.05$). The continuous-walking training group showed no changes in glycaemic control. In the interval walking training group, the insulin sensitivity ($57 \pm 17\%$, $P < 0.05$) increased, whereas the insulin secretion did not change ($3 \pm 6\%$, $P > 0.05$). The disposition index increased comparable to the insulin sensitivity ($60 \pm 16\%$, $P < 0.05$). In the continuous-walking and control group, no changes were seen in any of these parameters.

Conclusion: Free-living walking training is feasible in type 2 diabetes patients and interval-walking training is superior to energy-expenditure matched continuous-walking training upon improving glycaemic control. Furthermore, interval-walking induced improvements in glycaemic control seem to be dependent on improvements in insulin sensitivity and increased disposition.

Clinical Trial Registration Number: NCT01234155

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