

PhD thesis, Kristian Karstoft

ABSTRACT

BACKGROUND: Type 2 diabetes mellitus (T2DM) is a major and growing problem. Physical activity is a first-line treatment that is effective both for delaying the development and for reducing risk factors associated with T2DM. Supervised training is effective but unrealistic in terms of large scale implementation of physical activity in T2DM. Traditionally, moderate-intensity exercise has been recommended for T2DM subjects. In the recent years, higher intensity training has been suggested to be more beneficial, although no randomized controlled trial has been conducted to provide definitive evidence to support that claim. Interval-based training regimes, which increase peak training intensity, have shown promising results, but only a few carefully controlled studies exist. Moreover, it is not known whether free-living interval-based training is feasible and/or efficient in improving glycemic control in T2DM patients. Finally, the acute effects of every training intervention need to be established since T2DM subjects are recommended to be physically active on a regular basis.

OBJECTIVE: The overall objective of this PhD project was to determine the effect of free-living and minimally supervised interval-walking on glycemic control in subjects with T2DM, and to define the underlying mechanisms.

METHODS: A randomized, controlled trial evaluating the long term training effects of free-living interval-walking training compared to energy expenditure and time-duration matched continuous walking training was conducted. Glycemic control and other clinical variables (Manuscript 1) and mechanisms guarding changes in glycemic control (Manuscript 2) were assessed. Moreover, a cross-over, controlled trial evaluating the acute effects of a single interval-walking session compared to an energy expenditure and time-duration matched continuous walking session on glycemic control (Manuscript 3) was conducted. Both trials included T2DM subjects.

RESULTS: Interval-walking was superior to continuous walking in improving glycemic control in subjects with T2DM, after both long-term training and a single exercise session. Mechanisms explaining these improvements in glycemic control included increased insulin sensitivity and maintained insulin secretion, resulting in increased glucose disposition after interval-walking but not after continuous walking.

CONCLUSIONS: In subjects with T2DM, interval-walking is feasible and results in superior improvements in glycemic control when compared to energy-expenditure and time-duration matched continuous walking.

DANSK RESUME

Baggrund: Type 2 diabetes mellitus (T2DM) er et stort og voksende problem. Fysisk aktivitet er effektiv til såvel at forebygge sygdommens opståen som til at behandle det forhøjede blodsukker forbundet med T2DM. Traditionelt har man ikke anbefalet træning

med mere end moderat intensitet til personer med T2DM, men i de senere år har træningsprogrammer med høj intensitet vist sig at være meget effektive til at reducere blodsukker og andre risikofaktorer hos personer med T2DM. Interval-baserede træningsprogrammer, som alternerende øger træningsintensiteten sammenlignet med kontinuerlige træningsprogrammer, har vist lovende resultater, men kun få vel-kontrollerede studier eksisterer. Desuden er det uvist om ikke-superviseret interval-baseret træning er implementérbar og effektiv i forhold til at forbedre blodsukkerregulationen.

Formål: Det overordnede formål med dette PhD-projekt var at bestemme effekten af ikke-superviseret interval-gang på blodsukkerregulationen hos personer med T2DM, samt at belyse de underliggende mekanismer relateret hertil.

Metoder: Et randomiseret, kontrolleret studie med det formål at sammenligne 4 måneders interval-gang med energiforbrugs- og varigheds-matchet kontinuerlig gang blev gennemført i personer med T2DM. De interventions-inducerede effekter på blodsukkerregulation og andre kliniske variable (Manuskript 1) samt underliggende mekanismer relateret til ændringer i blodsukkerregulationen (Manuskript 2) blev undersøgt. Herudover blev et cross-over, kontrolleret studie, til evaluering af de akutte effekter af en enkelt interval-gangs-session sammenlignet med en energiforbrugs- og varigheds-matchet kontinuerlig gang-session på blodsukkerregulationen hos personer med T2DM (Manuskript 3) gennemført.

Resultater: Interval-gang var kontinuerlig gang overlegen ift. at forbedre blodsukkerregulationen hos personer med T2DM, efter såvel en 4 måneders træningsintervention som efter en enkelt træningssession. De underliggende mekanismer bag dette omfattede bl.a. øget perifer insulin-følsomhed, bevaret insulin-sekretion og dermed forbedret disposition indeks efter interval-gang men ikke efter kontinuerlig gang.

Konklusion: Interval-gang er implementérbart i personer med T2DM og interval-gang medfører overlegne forbedringer i blodsukkerregulationen sammenlignet med energiforbrugs- og varigheds-matchet kontinuerlig gang.