

# IMPACT OF EXERCISE TRAINING IN FED OR FASTED STATE IN TYPE 2 DIABETES MELLITUS PATIENTS ON INSULIN SENSITIVITY AND GLYCEMIC CONTROL: A RANDOMISED CLINICAL TRIAL

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## CONCLUSION:

- ▶ Three months of endurance exercise training, either executed in fasted or fed state, **lowered fat mass** and **improved peripheral insulin sensitivity and glycemic control** with similar magnitude in T2DM patients. Exercise sessions executed in fasted state did not lead to more hypoglycemic episodes and was perceived as less intense.



## INTRODUCTION

- In the care of type 2 diabetes mellitus (T2DM) **exercise training** is a cornerstone.
- Due to difficulties in adherence to long-term exercise interventions in T2DM patients, it is pursued to **optimize the clinical benefits of exercise training without demanding greater effort of the participants**.
- Recent studies **indicated significant greater improvements in insulin sensitivity** when healthy individuals execute exercise sessions in fasted vs. fed state during long-term exercise training interventions.

**Table 1. Impact of exercise intervention**

	Fasted state (n=12)		Fed state (n=12)		Time P value	Time*group P value
	Baseline	End	Baseline	End		
Total body mass (kg)	91.5 ± 11.5	89.7 ± 12.4	94.7 ± 15.9	93.3 ± 1.6	<0.001	0.610
Total fat mass (kg)	28.9 ± 6.0	27.4 ± 6.5	31.6 ± 9.2	30.0 ± 9.5	<0.001	0.904
Total lean mass (kg)	59.4 ± 7.1	59.1 ± 7.3	60.1 ± 7.1	60.3 ± 7.5	0.910	0.479
Fasting blood glucose (mmol/l)	11.4 ± 4.4	9.8 ± 5.0	9.0 ± 2.9	7.8 ± 2.0	0.020	0.760
HbA1c (%)	7.9 ± 1.8	7.7 ± 1.7	6.9 ± 0.9	6.7 ± 0.9	0.008	0.488
M (mg/kg/min)	11.6 ± 12.9	20.6 ± 17.9	14.5 ± 15.7	25.1 ± 18.6	0.006	0.487
VO2peak (ml/min)	2245 ± 616	2368 ± 632	2347 ± 693	2356 ± 634	0.278	0.350

Data are expressed as means±SD

## AIM

- To test the hypothesis that exercise training interventions, in which exercise sessions are executed in fasted state, are more effective as opposed to exercise interventions in which exercise sessions are executed in fed state in T2DM patients.

## METHODS

- Male T2DM patients (n=28, mean age 61±9 years, mean BMI 29.6±3.7kg/m<sup>2</sup>) were randomly assigned to **three months of supervised moderate-intense endurance exercise training** (at a heart rate at exactly 65% of VO2peak reserve) with exercise sessions (45 min) performed in **fasted** (n=14) or **fed** state (n=14)
- **Changes in peripheral insulin sensitivity** were assessed by hyperinsulinemic euglycemic clamp testing (glucose disposal rate (M)), as well as blood glycosylated hemoglobin (HbA1c) concentration
- **Changes in body composition** were evaluated by dual x-ray absorptiometry scan and changes in peak oxygen uptake (VO2peak) were recorded by maximal cardiopulmonary exercise tests
- One-way ANOVA with repeated measures was applied with statistical significance set at p<0.05 (2-tailed)

## RESULTS

- **MEDICAL SAFETY AND THERAPY COMPLIANCE**  
No adverse events occurred during the intervention period. On a total of 1008 exercise sessions, administration of monosaccharides occurred only once when one of the subjects showed hypoglycemic symptoms. Subjects attended 96±4% of all exercise sessions. Two participants in each group were lost during follow-up due to lack of motivation or illness.
- **CALORIC EXPENDITURE AND RATINGS OF PERCEIVED EXERTION (RPE) DURING EXERCISE TRAINING**  
Energy expenditure during the exercise sessions was similar between groups (P=0.478, on average 356±90 kcal/session in the fasted group versus 392±106 kcal/session in the fed group). The RPE, measured every exercise session, differed significantly between groups (P=0.007, on average 10±1.4 in the fasted group vs. 12±1.4 in the fed group).
- **CLINICAL EFFECTIVENESS**  
No significant differences in baseline characteristics were observed between groups (p>0.05, see Table 1), although blood HbA1c concentrations showed a trend for a difference between groups (p=0.051). As result of exercise intervention whole-body fat mass, fasting blood glucose and HbA1c concentration decreased, while M-value increased, significantly in total group (p<0.05). Changes in these parameters were not different between groups (p>0.05).