

Heart rate recovery after exercise and maximal oxygen uptake in sedentary patients with type 2 diabetes

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Aims

Heart rate recovery after exercise (HRR) is an estimate of autonomic modulation of the heart, and has been shown to be inversely associated with insulin resistance, metabolic syndrome, and type 2 diabetes.¹ Type 2 diabetes is associated with poor exercise tolerance and maximal aerobic capacity ($VO_2\max$).² Aim of our study was to assess the relationship between HRR and $VO_2\max$ in sedentary patients with type 2 diabetes.

Methods

Maximal treadmill exercise testing using standard or modified Bruce protocol was performed in 16 (8 males and 8 females) sedentary patients with type 2 diabetes (T2D), and in 16 (9 males and 7 females) age-matched sedentary non-diabetic controls (ND). HRR (bpm) was defined as the difference between maximum heart rate during the exercise test and heart rate 2 minutes after cessation of the exercise (Figure 1). The recovery protocol consisted of walking on treadmill at 2.0 km/h of speed and 0% of grade. Oxygen uptake was recorded and $VO_2\max$ (mL/kg/min) was defined as the highest 30 seconds average achieved during the test. For the statistical analysis of the data, Student's t-test for independent samples and linear regression analysis were used.

Results

The characteristics of subjects are shown in Table 1. The two groups were similar in age and body weight. BMI was higher in T2D (30.1 ± 3.6 vs 26.9 ± 4.2 , $P=0.029$). $VO_2\max$ was significantly lower in T2D compared to ND (20.6 ± 8.4 vs 28.2 ± 8.1 mL/kg/min, $P=0.002$) and, according to

Normative Table by age and gender from ACMS, the aerobic capacity was classified very poor in all T2D and in 11/16 of ND. HRR was significantly lower in T2D (28 ± 8.4 vs 37 ± 8.9 bpm, $P=0.008$). A significant correlation between HRR and $VO_2\max$ has been found in both T2D (Figure 2) and ND ($r=0.672$, $P=0.004$ and $r=0.620$, $P=0.010$ respectively).

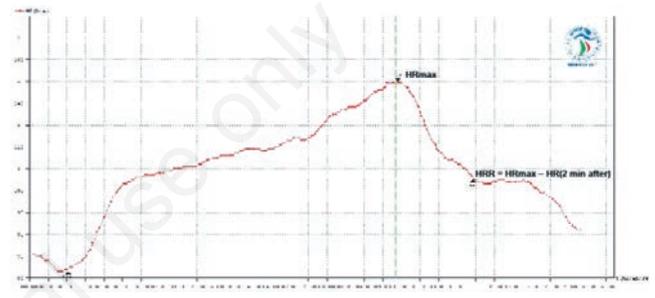


Figure 1. Example of heart rate recovery phase analysis after a maximum reached heart rate.

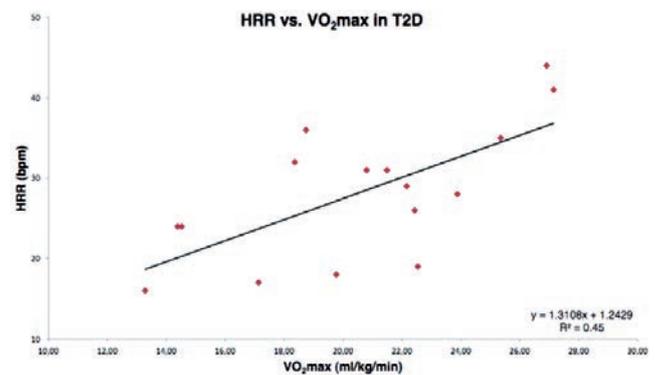


Figure 2. Correlation between heart rate recovery and $VO_2\max$ in type 2 diabetes patients.

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Table 1. Characteristics of subjects.

	T2D (n=16) Mean±SD	Control (n=16) Mean±SD	P
Age (years)	57±7.5	53±6.9	0.100
Height (cm)	165±7.7	166±9.8	0.826
Weight (kg)	82±10.7	74±15.5	0.119
BMI	30.1±3.6	26.9±4.2	0.029
HRmax (bpm)	130±16.1	143±13.5	0.024
$VO_2\max$ (mL/kg/min)	20.6±4.3	28.2±8.1	0.002
HRR (bpm)	28±8.4	37±8.9	0.008

T2D, type 2 diabetes; HRR, heart rate recovery.

Conclusions

The results of our study showed that both HRR and VO_2 max were significantly reduced in T2D *versus* ND. The positive linear correlation between HRR and VO_2 max suggests that in T2D the heart rate recovery after exercise, index of autonomic modulation, might improve in response to a training aimed to increase aerobic capacity.

References

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