

Mildly Attenuated Heart Rate Response During Exercise and Adverse Cardiovascular Outcome: Follow-Up of 10,323 Healthy Men and Women After Treadmill Exercise

Elad Maor¹, Eran Kopel², Yechezkel Sidi², Ilan Goldenberg¹, Shlomo Segev³, Shaye Kivity²

¹Leviev Heart Institute, Sheba Medical Center, Israel

²Internal Medicine C, Sheba Medical Center, Israel

³Institute for Preventive Medicine, Sheba Medical Center, Israel

Background:

Attenuated heart rate during exercise is associated with adverse cardiovascular outcome. However, heart rate response threshold is poorly defined. We investigated the correlation of heart rate response to exercise and adverse cardiovascular outcomes in 10,323 healthy men and women.

Methods:

We obtained data from 10,323 men and women without known cardiovascular disease or diabetes mellitus who underwent a yearly screening program at the Institute for Preventive Medicine of the Chaim Sheba Medical Center. Participants were grouped to three tertiles based on the maximal heart rate at the stress test performed during the baseline evaluation. The primary endpoint was the occurrence of cardiovascular or cerebrovascular vascular disease (CVD).

Results:

A total of 1,015 incident cases of CVD occurred during a mean follow-up of 4.3 years. A multivariate model showed that subjects with maximal heart rate of 60%-96% of the age predicted maximal heart rate (APMHR), had a higher CVD risk compared with subjects who reached the APMHR (HR 1.34; 95% CI [1.14-1.59], $p < 0.001$). Kaplan-Meier survival curve for CVD outcome is shown in the figure. The inset shows the same data on an enlarged y axis. A subgroup analysis among subjects who reached 85% of the APMHR, showed that even mildly attenuated heart response of 85%-96% of APMHR was independently associated with increased CVD risk (HR=1.36; 95% CI 1.15-1.61, $p < 0.001$). For subjects who reached 85%-100% of their APMHR, each 1% decrease in heart rate response was associated with 3% increase in CVD risk (HR 1.03 CI 1.01-1.05, $P < 0.001$).

Conclusions:

Attenuated heart rate response during exercise is a powerful and independent predictor of adverse cardiovascular events during long term follow-up among healthy men and women. The prognostic implications of attenuated heart rate response in this population are apparent even with a minor decrease of the maximal heart rate to less than 96% of the APMHR.

