IMPROVED HEART RATE VARIABILITY AND ENDURANCE PERFORMANCE IN SEDENTARY SUBJECTS

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INTRODUCTION

Recent studies suggest that the changes in heart rate variability (HRV) during night sleep could be used to evaluate the training load of the preceding day or cumulated training load of the preceding training period (Pichot et al. 2000; Hynynen et al. 2007). Furthermore, HRV changes may also be related to the changes in physical fitness (Hautala et al. 2004). The purpose of the present study was to investigate the individual performance and HRV responses to aerobic endurance training program in previously untrained subject.

METHODS

Sedentary women (n = 12) and men (n = 12) trained four weeks three times per week at the average running intensity of 76 ± 4 % of their heart rate reserve. The R to R ECG-intervals were recorded and HRV indices including high frequency power (HFP) were calculated for the nights following the training days every week. Endurance performance characteristics were measured in incremental treadmill test performed before and after the 4-week training period. The subjects were divided into responders and non-responders according to the changes in the endurance performance (vVO_{2max}). The responders were those subjects who improved vVO_{2max} more than 0.5 km/h (n = 12) and the others were included in the non-responders (n = 12).

Statistics

Repeated measures analysis of variance (ANOVA) was used to study the main effect and the interaction of the group and training on the treadmill test and nocturnal HRV results. Pearson product moment correlation coefficient was used to determine the relationships between the variables. Values are expressed as mean ± standard deviation.

RESULTS

In the first incremental treadmill test there were no significant differences in vVO_{2max}, VO_{2max} and velocity at anaerobic threshold (vAnT) between the two groups (Table 1). The responders improved their vVO_{2max} (10.9 ± 4.6 %) and vAnT (8.6 ± 5.4 %) but no changes were observed in the non-responders (1.6 ± 3.0 % and 2.6 ± 4.6 %, respectively).

Table 1. Results of the incremental treadmill test before and after the 4-week training period. [a] P < 0.001, [b] P < 0.01

	Responders		Non-responders	
	PRE	POST	PRE	POST
vVO_{2max} (km/h)	11.3 ± 1.9	12.4 ± 1.8[a]	11.8 ± 1.9	12.0 ± 1.9
VO_{2max} (ml/kg/min)	38.2 ± 6.2	39.4 ± 6.0	37.0 ± 6.1	39.5 ± 6.0
vAnT (km/h)	8.9 ± 1.3	9.7 ± 1.3[b]	9.2 ± 1.5	9.5 ± 1.6
HR_{max} (bpm)	190 ± 9	187 ± 7	195 ± 9	190 ± 8
$Lact_{max}$ (mM)	9.2 ± 2.1	9.5 ± 1.9	10.0 ± 2.3	9.1 ± 2.5

In the responders nocturnal HFP was significantly higher during the fourth training week compared to the first training week (P = 0.036) but no changes were observed in the non-responders (Figure 1). Furthermore, a significant correlation was observed between the change in vVO_{2max} and the change in nocturnal HFP (Figure 2). The training load variables of the two groups did not differ during the four week training period. The average HR in the training sessions was 77 ± 3 % of the maximal HR in the responders and 75 ± 3 % in the non-responders during the 4-week training period.

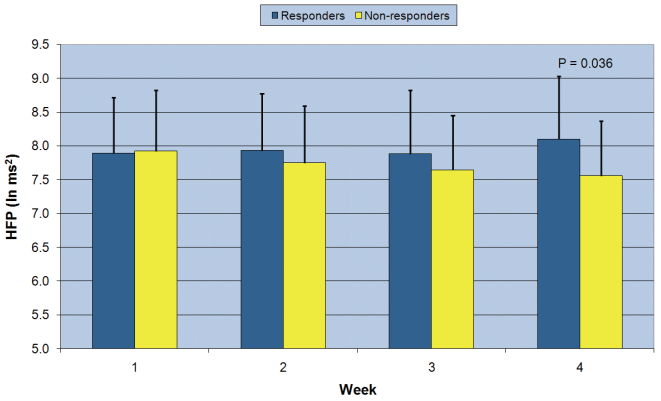

Figure 1. The average HFP during the 4-week of training in the responders and non-responders.

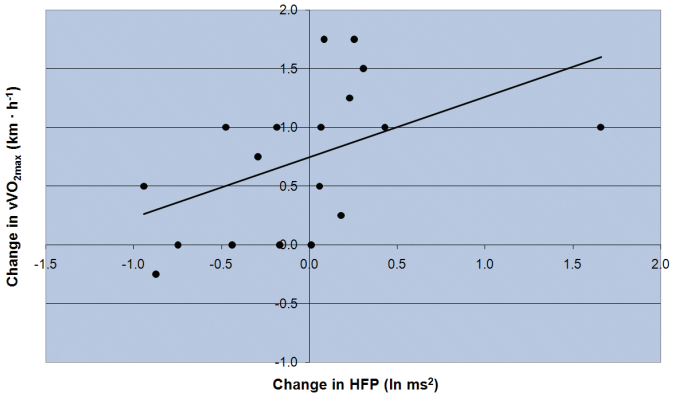

Figure 2. The relationship between the change in vVO_{2max} and the change in the nocturnal HFP between the first and fourth week of training.

DISCUSSION

The 4-week endurance training program was enough to induce 11 % increase in endurance performance in the responders. Despite the same volume and intensity of training in all the subjects the individual training response in the vVO_{2max} varied from -4 % to 21 %. The main result of the present study was that a relationship occurred between the changes in vVO_{2max} and the changes in HFP during the 4-week endurance training period. It was concluded that similar training resulted in different performance responses, which were related to the changes in cardiac autonomic modulation during sleep. Monitoring nocturnal HRV seems to provide useful method in evaluating responses to endurance training and in building up a training program in sedentary subjects.

REFERENCES

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