The Effects of Long Term Sport Rock Climbing Training on Heart Rate Variability in Sedentary Adults

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Introduction

- The lack of regular physical activity and improved reduced physical fitness levels are related to
- cardiovasculardisease, hypertension, stroke, osteoporosis, type 2 diabetes, obesity, colon cancer, breast cancer as well as anxiety and depression(Wenger et al., 1995; Leitzmann et al., 1999; Feskanich et al., 2002; Haskell et al., 2007).

Introduction

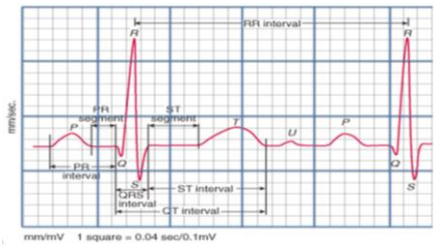
- For this reason, a number of studies have investigated chronic physiological and psychological effects of different long-term regular physical activity types in sedentary adults and demonstrated significant improvements on health related physical fitness parameters and anxiety levels (Nikseresht et al., 2014; Fourie et al., 2013; Osawa and Oguma, 2013; Smith et al., 2013; DeLima et al., 2012; Sekendiz et al., 2010; Vogelsang et al., 2008) .

Introduction

- Heart rate variability (HRV) is a non-invasive method to evaluate the autonomous heart functions(Myllymaki et al., 2012), and has been used in the field of sports sciences to investigate chronic effects of exercise and acute effects of physical activity(Hnidawei et al., 2010) by examining parasympathetic and sympathetic influences on heart.

Introduction

- The successful adaptation of HRV to physical activity has a critical importance not only for the expectation of increased performance of an athlete but also the health of an athlete.



Purpose

- The purpose of the research was to determine whether an eight-week sport rock climbing training (SRC) period causes long-term change in heart functions.

Methods

- A total number of 19 healthy university students voluntarily participated in the study. Subjects were randomly divided into CG and EG.

- Both groups did not take part in any other physical activity program for at least six months prior to this study.

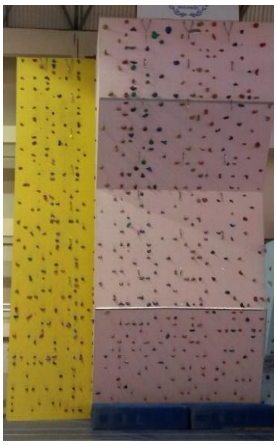
	N	Age (years)	Body height (cm)	Body weight (kg)
Control	4M/6F	21.90 ±1.66	168.50 ±4.40 cm	61.18 ±7.08 kg
Experimantal	5M/4F	21.11 ±2.31	167.33 ±6.44 cm	59.31 ±8.39 kg

Methods

- The subjects exercised 3 days a week for 8 weeks, 60 minutes in each session at the level of 70 % of HRmax.
- Prior to the study, the subjects were trained to have basic holding and stepping skills, as well as safe usage of materials and rope techniques were taught for climbing in four familiarization sessions.

Methods

- SRC trainings were between 16:00 and 19:00 hours, and performed on the 12 m-high indoor artificial climbing wall. All the climbing exercises were done by using the top-rope technique, which prevents falling and served as a safety line.



Methods

- All subjects received pre-test measurements of body composition, aerobic power, and heart rate variability for the 4 days prior to the start of the climbing exercises, and immediately after the end of the 8-week training period the HRV measurement was repeated.

Methods

- Heart rates were determined by using the HRreserve method [Target HR = (percentage of load) x (HRmax - HRrest) + HRrest] during training (Ehrman et al., 2010) for each subject.

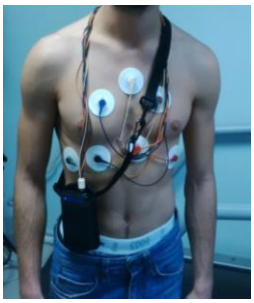
- HRrest was taken before the HRmax test (Bruce treadmill test protocol), after having the subjects lay down for 5 minutes (Donath et al., 2014).

Methods

- Each subject had their monitors (Polar Team 2 Polar, Finland) adjusted within ±5 HRtarget range in order to achieve desired exercise intensity, and accordingly, the subjects asked to change their pace of climbing.

Methods

- HRV was conducted by using a Biomedical branded VX3 Digital ECG Recorder (CA, USA) and the results were interpreted by cardiology specialists.



Methods

- The HRV parameters derived from the device were;

- HRtot: Total heart rate; HRmax: Maximum heart rate; HRave: Average heart rate; HRmin: Minimum heart rate; SDNN: standard deviation of all NN intervals; SDANN5: standard deviation of the averages of NN intervals in all five-minute segments of the entire recording; PNN50: percent of difference between adjacent NN intervals that are greater than 50 ms; RMSSD: square root of the mean of the sum of the squares of differences between adjacent NN interval; TRIA: Triangular index.

Methods

- An SPSS 20 (SPSS Inc., Chicago, IL, USA) was used for the statistical data analyses of the research. The distribution of data was tested for parametric or nonparametric tests.

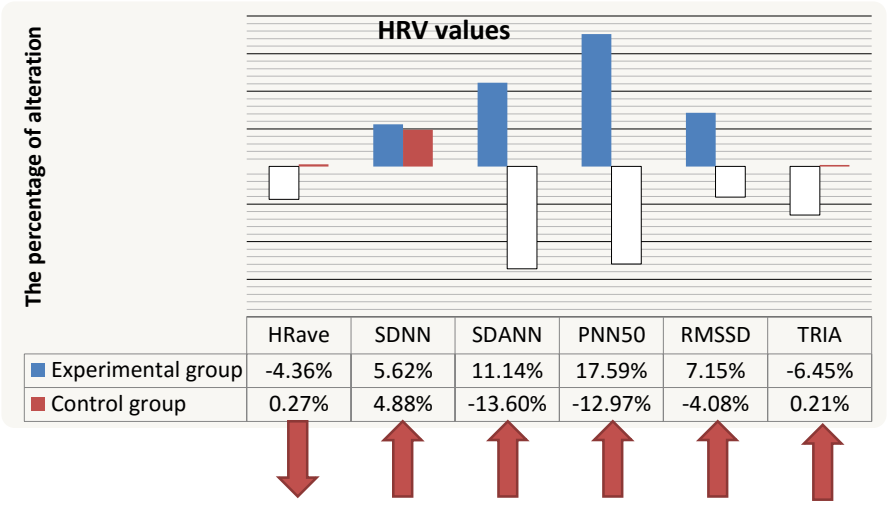
- The normality distribution was tested using a Shapiro Wilk test, the normal distribution parametric was subjected to a Paired Sample t-Test, and the nonparametric distribution was given a Wilcoxon test. An alpha value of 0.05 was accepted for all of the statistical analyses.

Results

Table 1. HRV values and their mean differences obtained from pre- and post-tests.

Parameters	Pre test	Post test	*p* value
	Control Group		
HRtot	99499.60 ± 15094.74	100296.30 ± 16528.32	0.859
HRmax	167.70 ± 41.12	177.70 ± 34.95	0.114
HRave	75.10 ± 8.22	75.30 ± 8.24	0.719
HRmin	43.90 ± 6.15	44.80 ± 6.17	0.475
SDNN	180.50 ± 28.62	189.30 ± 35.05	0.439
SDANN	91.90 ± 29.30	79.40 ± 16.52	0.415
PNN50	27.70 ± 8.74	24.10 ± 8.35	0.106
RMSSD	66.70 ± 25.28	64.00 ± 17.23	0.721
TRIA	792.80 ± 151.42	794.50 ± 165.03	0.976
	Experimental Group		
HRtot	91173.56 ± 13519.90	94301.89 ± 14166.33	0.449
HRmax	156.56 ± 23.70	159.11 ± 19.14	0.788
HRave	70.11 ± 9.64	67.00 ± 10.76	0.369
HRmin	42.33 ± 6.65	41.67 ± 6.96	0.833
SDNN	203.77 ± 37.44	215.00 ± 51.71	0.607
SDANN	94.11 ± 30.33	104.56 ± 34.81	0.411
PNN50	29.67 ± 12.65	34.89 ± 15.25	0.406
RMSSD	73.00 ± 26.04	78.22 ± 34.26	0.638
TRIA	899.00 ± 237.17	841.67 ± 234.98	0.542

Results



	HRave	SDNN	SDANN	PNN50	RMSSD	TRIA
Experimental group	-4.36%	5.62%	11.14%	17.59%	7.15%	-6.45%
Control group	0.27%	4.88%	-13.60%	-12.97%	-4.08%	0.21%

Experimental group.

Discussion

- It is known that regular physical activity has many positive effects on health protection and development, and HRV is a useful indicator to observe the effects.
- Although, some improvements were seen in some HRV data in the experimental group (on HRave, SDNN, SDANN, PNN50, and RMSSD) at the and of the training period, the changes were not significant.

Discussion

- Studies, investigating the effects of different activity type and duration on HRV.

Aouthor/s and year	Duration and type	Changes on HRV
Jakubec et al.; 2008	3 days a week for six month, 40-45 min per session; step-aerobic	No change
Lu and Kuo; 2012	40 min a day, seven days a week; Tai Chi Chuan	No change
Martinmaki et al.; 2008	14-week; aerobic exercise	No change
Perini et al.; 2002	3 days a week for eight weeks, 60 min per session; aerobic exercise	No change
Verheyden et al.; 2006	One year; aerobic and power training	No change

Discussion

- Studies, investigating the effects of different activity type and duration on HRV.

Aouthor/s and year	Duration and type	Changes on HRV
Grant et al.; 2012	12-week moderate intensity; cardiovascular and muscle strength exersice	LF/HF, LFnu, HFnu
Cornelissen et al.; 2010	3 days a week for 10 weeks, 50 min per session, ; bicycle and step	TP
Papp et al.; 2013	60 min per week for eight weeks; hatha yoga	PNN50

Discussion

- In accordance with the results derived from the current study, exercise experts should plan programs which are longer than eight weeks in order to see significant changes if they intend to use sport rock climbing as the main activity in exercise programs that target functional enhancement in the heart.

Discussion

- The same research can also be carried out by creating a second experimental group undergoing an aerobic exercise program which will be accepted as a standard in some studies.

- Thus, chronic adaptations that occur as a result of SRC can be compared with other types of activities in a more accurate and simultaneous manner.