Programming training loads MTB cyclists during first 7-days of the stay in conditions of high-altitude hypoxia

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Introduction

- Determining the relationship between internal and external training loads, is of vital significance when conducting sports training. (Weaving et al. 2014)
- This relationship depends on a number of factors, among which, the conditions of the effort carried out, are of crucial importance.
- High-altitude hypoxia is a factor used in training in order to obtain the competitor's internal load while applying a lower external load value. (Hahn, Gore 2001, Saunders et al. 2009)

Influence of the height on the change of conditions external environment

Kenney et al. Physiology of sport and exercise Human Kinetics :311, 2011

Altitude (ft) (m)	0 (sea level) 0	5,202 1,610	7,251 2,210	14,108 4,300	29,028 8,048
Barometric pressure P_b (mmHg)	760	631	585	430	253
% O_2 in the air	20.93	20.93	20.93	20.93	20.93
Partial pressure of oxygen PO_2 (mmHg) in the air	159	132	122	90	53
Typical temperature (°C) (°F)	15 59	9 47	2 36	−11 12	−43 −46

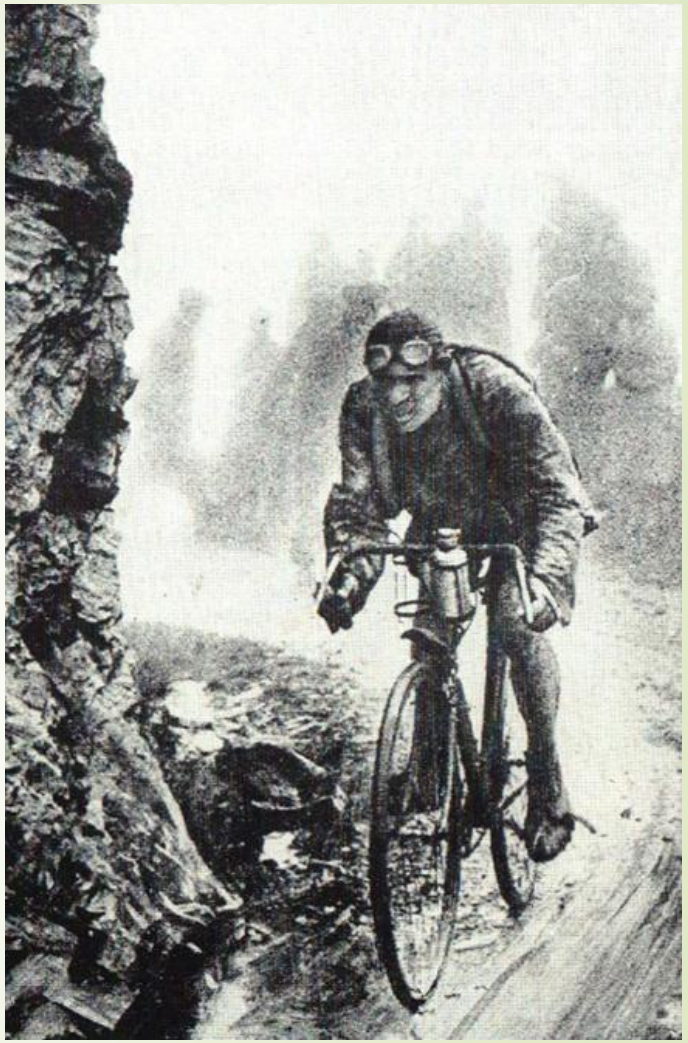
- **Hematological effects of training in accordance with the LH-TH (live high – train high) model is well–defined**

(Stray-Gundersen, Levine 2008)

- **Special attention has been paid to conditioning of the effect of a 2-3 week stay at altitude combined with various combinations of training loads (Friedmann-Bette 2008)**

Aim of the study

- The first aim of this investigation was to determine a direction and range of training loads during the first week of MTB cyclists stay at the altitude of 2250 m above sea level.
- The second aim of this investigation was amounts of intensity basic training loads applied during first 7-days of the stay in conditions of high-altitude hypoxia



Material of investigation

- The participants of the study were mountain bike cyclists, members of The Russian and Polish Nationals Teams (women n=12, 25.4/2.1year, 50.3/2.2kg, 160.3/5.5cm).
- At the altitude of 170 MAMSL (Lonato del Garda, Italy),
- 2250 MAMSL(Livignio-Trepale Italy)

Applied equipment and methodology

- They took the graded exercise test (GXTs) at the altitude of 170 m (Lonato del Garda, Italy) and 2250 m (Livignio-Trepale Italy). The GXTs test was taken on a Cyclus 2 ergometer (RBM, Germany). The first step was 1Wxkg-1 b.m, increased every 3 minutes by 0,5 Wxkg-1 b.m.

Applied equipment and methodology

- During the test, the following parameters: VO2, VE, VCO2 were measured using the K4b2 analyser. The heart rate monitor, Polar V650 (Polar Finland) measured HR during GXTs. In the last 30, seconds of every exercise grade, 20 µl of arterialized blood were drawn for the LA marker (Biosen S-line, EKF, Germany).

Methodology of investigation

The participants of the study underwent effort test:

- Graded Incremental Exercise Test (GXTs – determining internal load values VO_2, VE, VCO_2, HR on the external loads level (P, W/kg), from 50 to 100% taking lactate threshold (LT), and anaerobic threshold into account

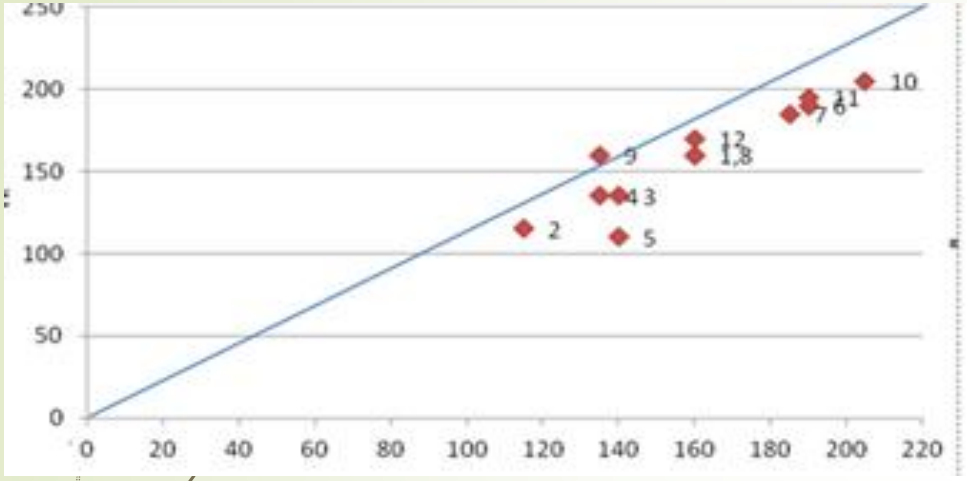
Methodology of investigation

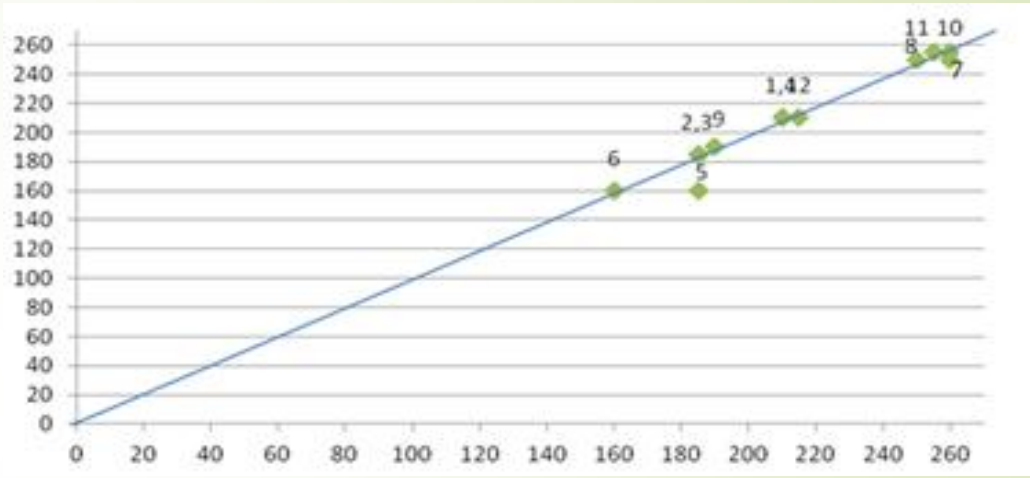
- Power was measured at the following thresholds:
- aerobic (LT) (Farell et al. 1979 Med.Sci.Sport Exerc.11:338-44),
- anaerobic (AT) (Powers et al. 1983 Res.Q.Exerc.Sport 54:179-82) and VO2max.
- The purpose of the training was to execute the seven day program at the altitude of 2300-2100 m above sea level.

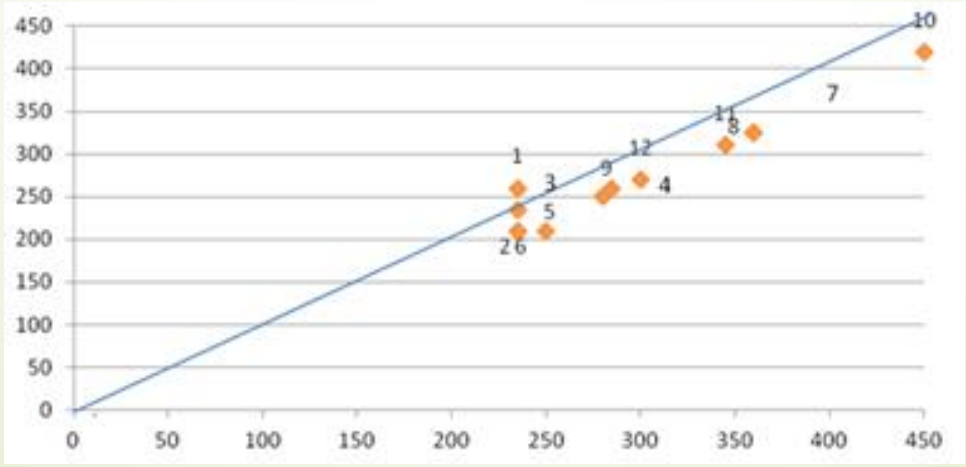
Methodology of investigation

- After physiological tests, the following changes were evaluated:
- oxygen consumption (VO_2),
- ventilation (VE),
- heart rate (HR),
- power (P) at VO_2max,
- aerobic threshold (LT)
- anaerobic threshold (AT).

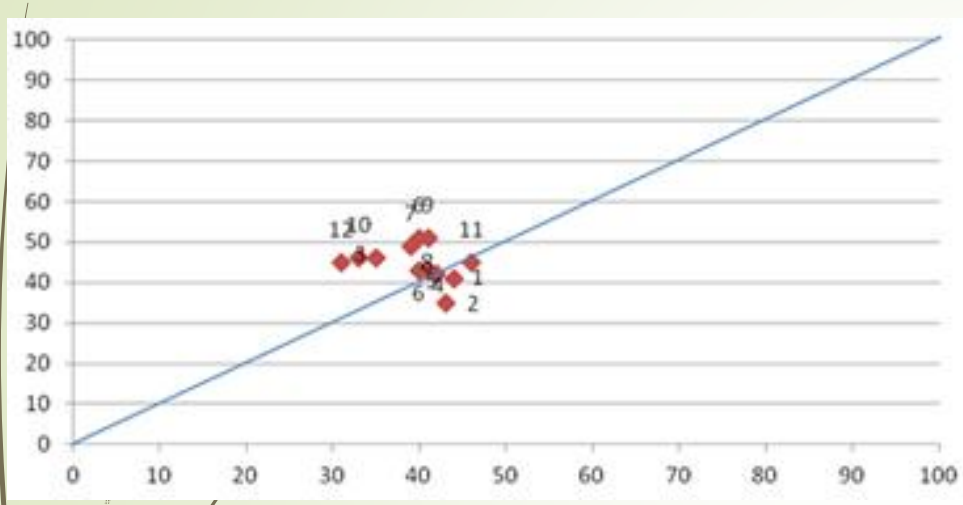
Power (W) on intensity LT, AT and maximal

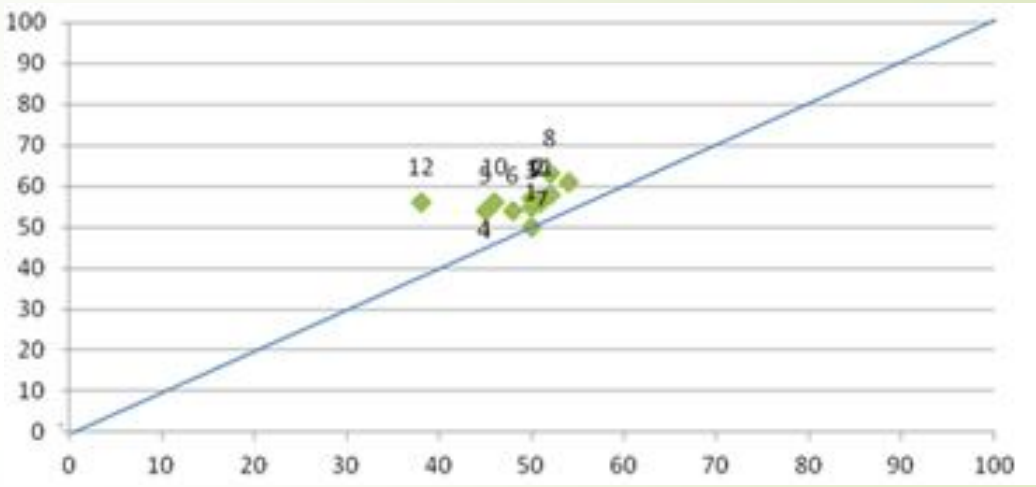


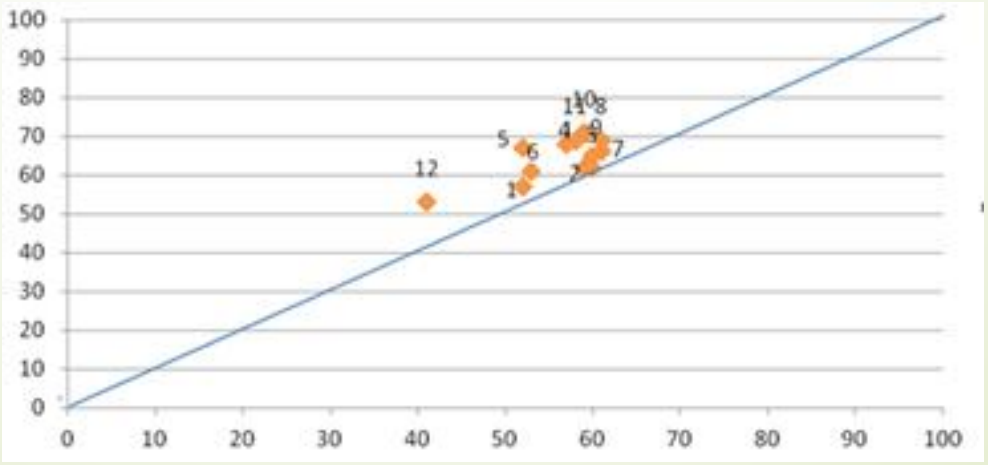




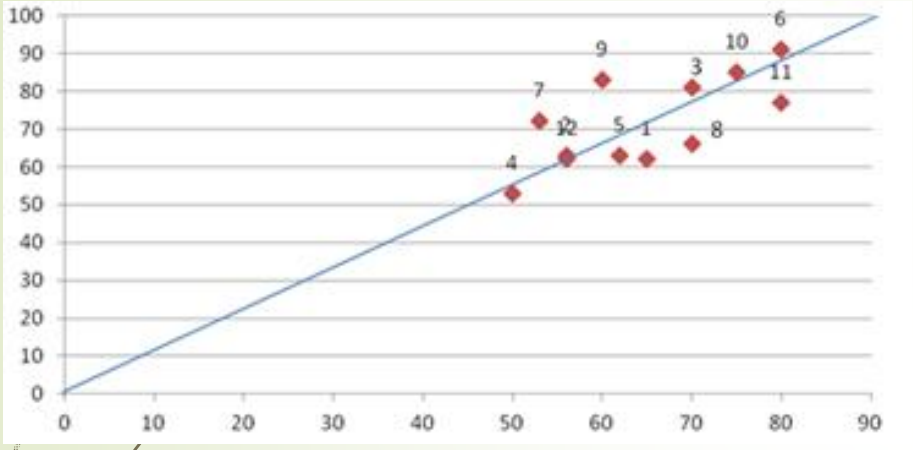
VO_2 (ml/kg/min)on intensity LT, AT and maximal

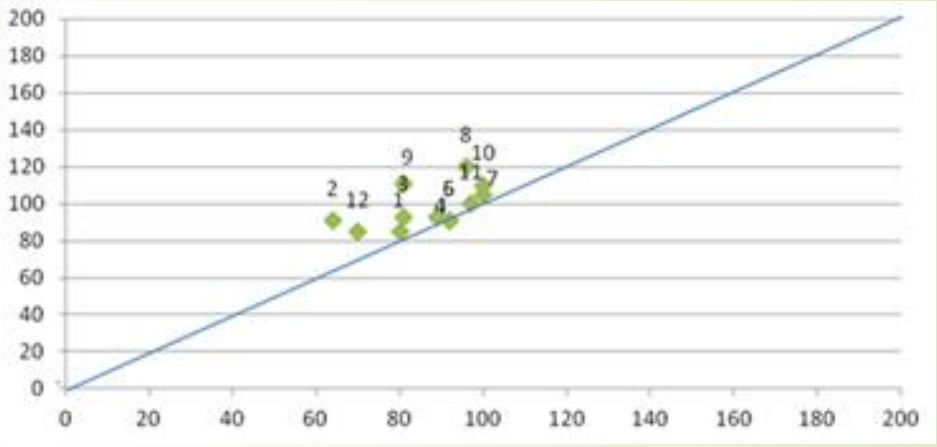


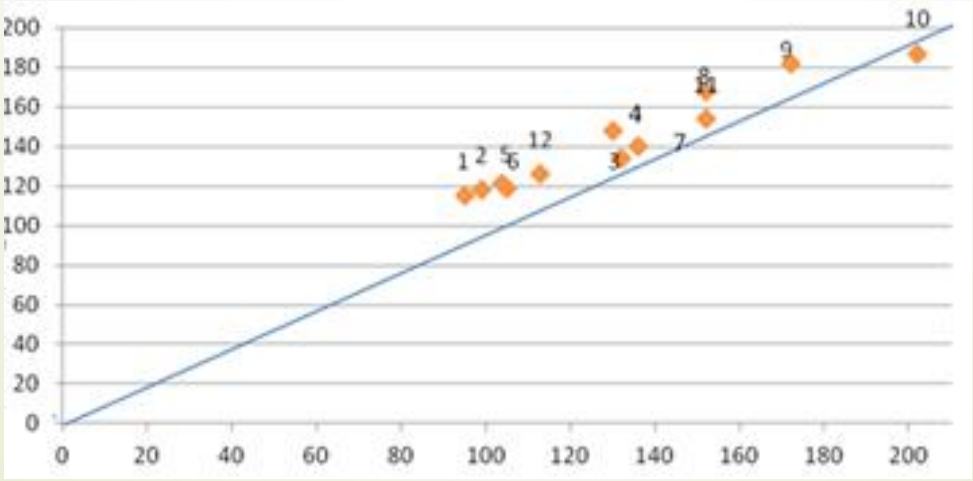




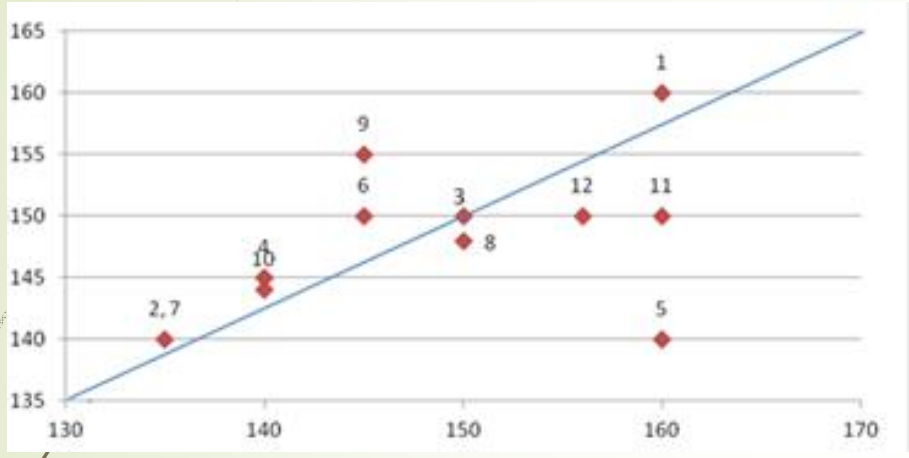
VE (l/min) on intensity LT, AT and maximal

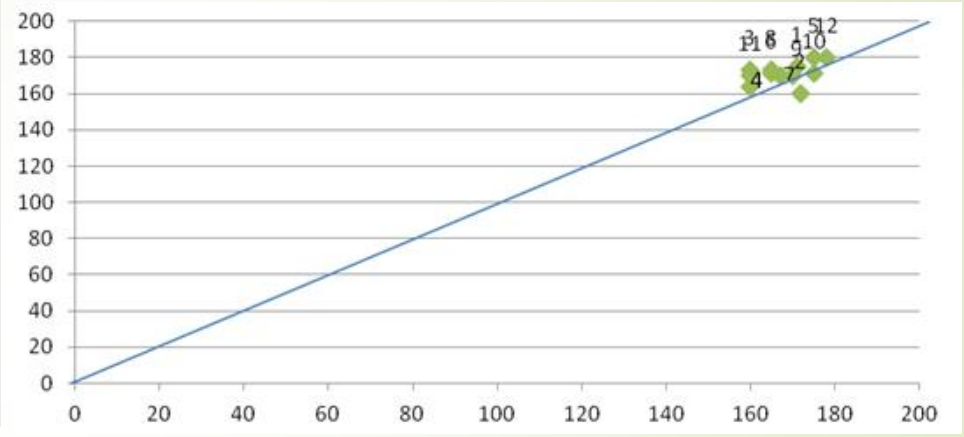


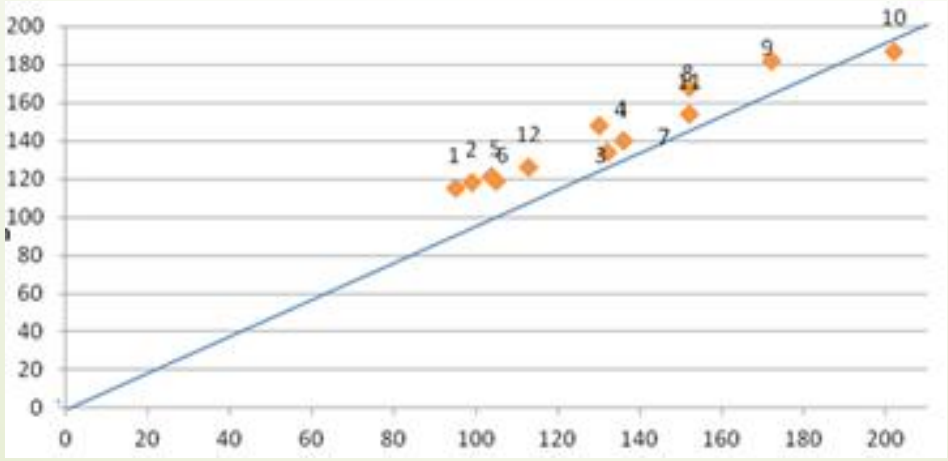




HR (bp/min) on intensity LT, AT and maximal





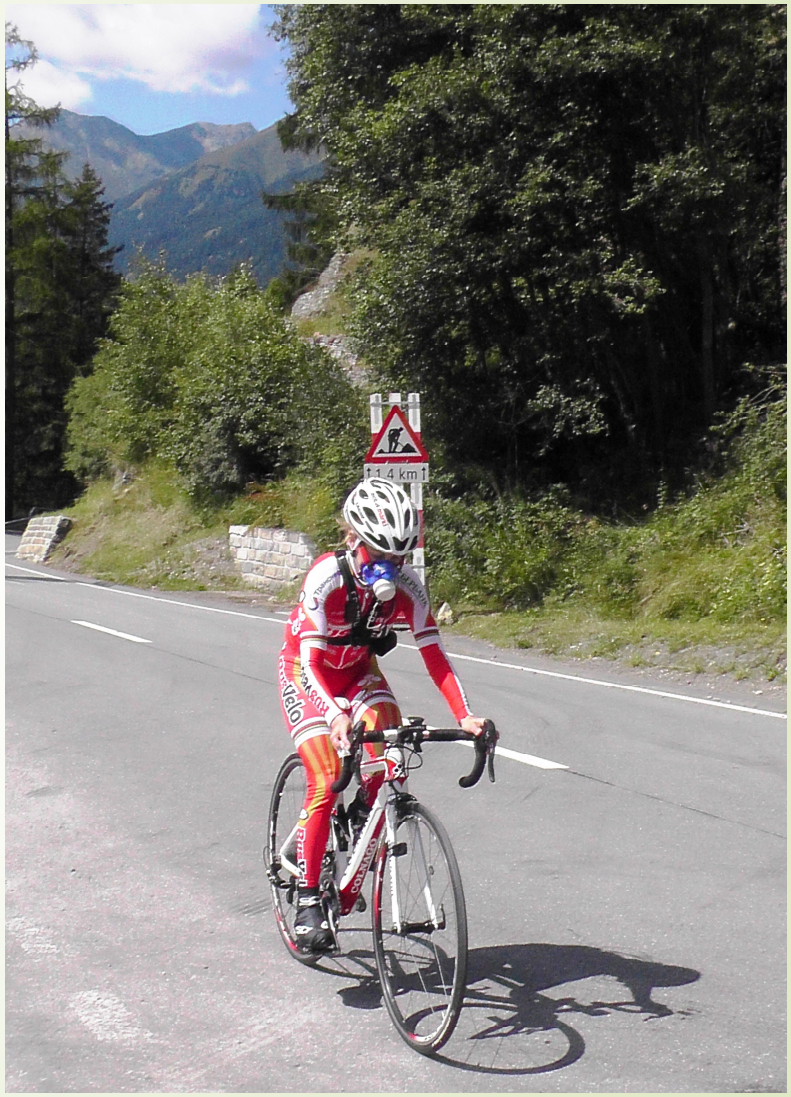


The characteristics of the changes of physiological indicators

The scope of the changes is individual

- On LT: P↓, VO2↑, VE↔, HR↔,
- On AT: P↔; VO2↑; VE↑; HR↑;
- On Pmax: P↓; VO2↑; VE↑; HR↑;

These results were used to adjust training load parameters



Practical application

Changes of the value of parameters of training loads in the result of the reaction to the high-altitude hypoxia

Character of the work	Direction of the training load	Conditions and contents of the training	
		Hypoxia	Normoxia
Constans power	Compensation on bicycle	2,5 – 2,7 W/kg b.m.	2,8 – 3,0 W/kg b.m.
Changeable intensity	Strengh in gym	70-75% max load	80-90% max load
		5 exercise x 4 repetition x 3 series for uper and 2 series for lower body	5 exercise x 6 repetition x 3 series for uper and 3 series for lower body

Practical application
Changes of the value of parameters of training loads in the result of the reaction to the high-altitude hypoxia

Character of the work	Direction of the training load	Conditions and contents of the training	
		Hypoxia	Normoxia
Changeable intensity	Endurance on bicycle	15'/2,9-3,1W/kg b.m. Compensating break 15'/<LT x 4	15'/2,9-3,1W/kg b.m. Compensating break 15'/<LT x 4
Changeable intensity	Power on bicycle	Hight cadence 110-120 4x(4'/3,2-3,5 Compensating break 4'/<LT	Hight cadence 110-120 6x(4'/3,8-4 W/kg b.m. Compensating break 4'/<LT)
Changeable intensity	Strengh on bicycle	6x(1'/3,8-4,0 W/kg b.m.+1'/3,4-3,6W+1'/3,8-4,0 W/kg b.m. Compensating break 3'/<LT	8x((1'/4,0-4,2 W/kg b.m.+1'/3,6-3,8W+1'/4,0-4,2 W/kg b.m. Compensating break 3'/<LT

Thank you for your attention

ФЕДЕРАЦИЯ ВЕЛОСИПЕДНОГО СПОРТА РОССИИ

P.Z.KOL.