INTRODUCTION

Infectious mononucleosis (IM) is a disease caused by the Epstein-Barr virus which afflicts many athletes each year (Putukian et al., 2008). A conservative way of treating IM is commonly accompanied by the advice of the restriction of contact sport (Papesch & Watkins, 2001) and/or intensive physical activity and e.g. the diet (Candy, Chalder, Cleare, Wessely, & Hotopf, 2005). However, athletes often rush the return to training and competition participation, and thus risk a relapse of health complications linked with fundamental disease. In literature, there is still a lack of information or ambiguous recommendations how to manage convalescence after IM in term of the suitable start or optimal intensity of exercise. Some authors recommended beginning with low physical activity after two week (Welch & Wheeler, 1986), but also after 8 weeks (Moolenar, Peters, & Bolk, 1988). The consensus from more current literature is that light noncontact activities may commence 3 weeks from symptom onset, but the returning to contact activities is more complicated (Putukian et al., 2008). Moreover, from review of Waninger and Harcke (2005) results that no strong evidence-based information supports use of a single parameter to predict the safe return to sport participation.

Spectral analysis of heart rate variability (SA HRV) is a non-invasive method which enables quantification of autonomic nervous system (ANS) activity which is accepted as sensitive marker of homeostatic disturbances (Aubert, Seps, & Beckert, 2003). It well documented that IM is associated with the prolonged fatigue (Katz, Shiraishi, Mears, Binns, & Tailor, 2009; Rea, Russo, Katon, Ashley, & Buchwald, 2001) that causes an im-
pairment in ANS activity in terms of the reduction in vagal activity and the shift of sympathovagal balance towards sympathetic predominance (Wyller, Barbieri, Thaulow, & Saul, 2008). Impairment in autonomic regulation may induce a decrease in adaptation capacity of athlete that delays a convalescence process. On the other hand, higher ANS activity is linked with better homeostasis regulation which could positively affect physical performance (Pichot et al., 2002).

The main purpose of this study was to design a convalescence program for elite athlete after IM which was based on the maintaining ANS activity in balance via optimization of training intensity using SA HRV.

METHODS

Participants

One elite Czech basketball player after IM volunteered to participate in the present study. He was a non-smoker and during the study he did not use any medication which may affect ANS. Characteristics of the athlete is presented in TABLE 1.

Time frame of health complication and subsequent treatment

An acute cytomegalovirus accompanied with elevation of transaminase level was identified in our subject in January 2010. Athlete underwent a standard treatment (a strictly diet with rest on bed) lasting two months which resulted in an improvement in health status. Thus, he decided for the return to play. Unfortunately, deterioration in health complication associated with the fundamental disease occurred after one month from the return to competition again. The relapse caused another interruption of sport participation including physical activities for next two months when he was still highly fatigued, and frequently suffered by infection of the upper respiratory tract.

Approximately in half of August 2010 began the convalescence program which lasted to the end of the September 2010. Athlete returned for the first time to competition in the 6th of September, and during next month he fully participated in the basketball training and competitions. Particular parts of developed program including both the exercise intensity, and training drills are clearly presented in TABLE 2. During convalescence period athlete repeatedly underwent analysis of alanine amino transferase (ALT) level; aspartat amino transferase (AST) level, and gama glutamyl transferase (GGT) level (TABLE 5).

Experimental design

Before the study started, the participant was closely informed about the study design, and then he submitted written informed consent. Further, athlete underwent preliminary measurements in order to preclude any medical or health limitations to performing the maximal exertion test. Before performing of maximal stress test, athlete repeatedly underwent analysis of alanine amino transferase (ALT) level; aspartat amino transferase (AST) level, and gama glutamyl transferase (GGT) level (TABLE 5).

TABLE 1

<table>
<thead>
<tr>
<th>Parameter [unit]</th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age [year]</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>BMI [kg.m⁻²]</td>
<td>21.73</td>
<td>22.01</td>
</tr>
<tr>
<td>Body Fat [%]</td>
<td>9.1</td>
<td>7.6</td>
</tr>
<tr>
<td>HRrest [BPM]</td>
<td>65</td>
<td>53</td>
</tr>
<tr>
<td>HRmax [BPM]</td>
<td>180*</td>
<td>177</td>
</tr>
<tr>
<td>VO₂peak [ml.kg⁻¹.min⁻¹]</td>
<td>36.8 *</td>
<td>61.1</td>
</tr>
<tr>
<td>MPO [W.kg⁻¹]</td>
<td>3.4*</td>
<td>7.0</td>
</tr>
<tr>
<td>BP [torr]</td>
<td>128/72</td>
<td>124/79</td>
</tr>
</tbody>
</table>

Legend: HRrest – resting heart rate, HRmax – maximal heart rate, BPM – beat per minute, BP – blood pressure, VO₂peak – peak oxygen uptake, BMI – Body Mass Index, MPO – maximal power output, percentage of body fat was computed from 10 skin fold caliper testing according to Pařízková (1962), * value was achieved during measurement on bicycle.

TABLE 2

<table>
<thead>
<tr>
<th>Convalescence</th>
<th>1st phase</th>
<th>2nd phase</th>
<th>3rd phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR [BPM]</td>
<td>110–125</td>
<td>125–145</td>
<td>145–175</td>
</tr>
<tr>
<td>HRmax [%]</td>
<td>61–66</td>
<td>66–77</td>
<td>77–97</td>
</tr>
<tr>
<td>Duration [min.]</td>
<td>10–20</td>
<td>30–50</td>
<td>60–90 (120)</td>
</tr>
<tr>
<td>Physical activity</td>
<td>Walking (uphill-downhill), swimming, cycling on stationary bicycle, rowing on simulator, easy work out with own body.</td>
<td>Jogging, swimming, cycling, rowing on simulator, moderate work out with own body, athletics training.</td>
<td>Running, work out, swimming, basketball drills, athletics training, circle resistant training.</td>
</tr>
</tbody>
</table>

Legend: HR – heart rate, BPM – beat per minute, HRmax – maximal heart rate, % – percentage, min. – minute.
and monitoring of resting ANS activity. All measurements were performed between 8 to 10 a.m. Athlete was required to avoid eating and drinking any substance affecting ANS activity for minimally 2 hours before the ANS measurement.

Pre-convalescence maximal stress test was performed on a bicycle ergometer Ergoline 900 in order to establish the peak oxygen uptake (VO$_2$peak) and maximal heart rate (HRmax). Ventilation and gas exchange were continually analyzed (Oxycon 4, Mijnhardt Holland) during the exercise and were reported as mean for 30 s. Post convalescence maximal stress test was performed on a treadmill (Lode Valliant, Netherlands). Ventilation and gas exchange were continually analyzed (ZAN 600 Ergo USB, Germany) during the exercise and were reported as mean for 30 s. HR responses were monitored (S810 Polar, Finland) continuously during both maximal exercise tests.

ANS activity was measured by the athlete himself after properly training each day in the morning. Electrocardiographic data were continually sampled in a quiet room during a standardized ortho-clinostatic maneuver of lying–standing–lying by system VarCor PF 7 (Salinger & Gwozdziewicz, 2008) which requests for short-term spectral analysis of HRV both 300 R–R intervals and 300 seconds per position. Frequency domain analyses were performed according to the methods described by Salinger et al. (1998). Amplitude density of the collected signal was estimated using the fast Fourier transform method with a partly modified Coarse-Graining Spectral Analyze algorithm (Yamamoto & Hughson, 1991). Power of mean spectral components were calculated by integrating area under the power spectral density curve in the frequency ranges according to Salinger et al. (1998) – power very low frequency (P$_{VLF}$) 0.02–0.05 Hz; power low frequency (P$_{LF}$) 0.05–0.15 Hz, power high frequency (P$_{HF}$) 0.15–0.5 Hz, and total power (P$_{T}$) 0.02–0.5 Hz, respectively. Resting heart rate (HRrest) was computed as a mean for 5 min. in second lying position. The autonomic cardiac activity was also expressed by complex indexes of SA HRV (Stejskal et al., 2002) – the complex index of the vagal activity (VA), the complex index of the sympathovagal balance (SVB) and the complex index of the total score (TS). Parameter function age (FA) represents the value of TS which was adjusted into the age. The reference values of SA HRV indexes range from $-5.0$ to $+5.0$ points. The physiological values have been established for both VA and SVB in range from $-2.0$ to $+2.0$ points; for TS from $-1.5$ to $+1.5$ points (Stejskal, Přikryl, & Jakubec, 2004).

The aim of the optimizing process was to keep the ANS activity in balance and throughout avoiding long-term reduction in ANS activity due to excess training load. The process starts automatically when the subject finished at least the fifth measurements of ANS activity. Optimizing procedure is based on comparing a magnitude of differences between ANS activity in actual measurement with the mean of ANS activity at least five and maximally twenty previous measurements. In this case, autonomic activity is represented by FA. The tested subject received one of the four possible recommendations – an increase in intensity; preserved actual intensity; reduce intensity and/or temporally interrupt the training. The whole procedure is detailed described in study of Šlachta, Stejskal, and Elfmark (2003).

In all training sessions, HR was controlled by HR Polar 810 monitor (Finland). Immediately after training sessions was evaluated perceived exertion on the 16 points Borg scale. The athlete further assessed the feeling of fatigue each time before the ANS activity measurement. The level of subjective feeling of fatigue ranged from 0 (no fatigue) to 5 (extremely high) point(s). This scale was established only for this project, therefore it was not validated.

**Statistical analysis**

Data were analysed using software STATISTICA 9.0. The normal Gaussian distribution of the analysed data was verified by the Kolmogorov-Smirnov test. Values of HR, fatigue, and perceived exertion were tested using one-way repeated-measures of ANOVA with Fischer LSD post hoc test. Kruskal-Wallis H-test followed by Wilcoxon test (post hoc analysis) was conducted to examine the effect of exercise on complex index of SA HRV. Relationship between selected variables was analyzed by Pearson correlation. In all analysis, $p \leq .05$ was considered to be statistically significant.

**RESULTS**

TABLE 3 shows that a significant increase in mean $P_{VLF}$, $P_{LF}$, $P_{HF}$, $P_{T}$ and ratio $P_{VLF}/P_{HF}$ was found in the 2$^{nd}$ and the 3$^{rd}$ period compared to the 1$^{st}$ period in standing position. The mean $P_{A}$ and $P_{T}$ significantly increased in the 3$^{rd}$ compared to 2$^{nd}$ period in standing. Mean HR in standing position decreased significantly among periods. In lying position, only $P_{VLF}$ and ratio $P_{VLF}/P_{HF}$ significantly increased in the 2$^{nd}$ compared to the 1$^{st}$ period. The mean $P_{VLF}$, $P_{LF}$, $P_{T}$ and ratio $P_{VLF}/P_{HF}$ and $P_{LF}/P_{HF}$ significantly increased in the 3$^{rd}$ period compared to the 1$^{st}$ period. The ratio $P_{LF}/P_{HF}$ significantly increased also in the 3$^{rd}$ period compared to 2$^{nd}$ period. A significant reduction in mean HR in lying position was investigated only in the last period compared to both previous periods.

TABLE 4 shows that statistical analysis did not find any significant differences in mean values of complex index of SA HRV among periods. A significant increase in mean value of perceived exertion occurred between subsequent periods. The mean value of perceived fatigue was significantly higher only in the 3$^{rd}$ period compared to the 1$^{st}$ period (TABLE 4).
### TABLE 3
Statistical analysis of individual variables of SA HRV during convalescence periods

<table>
<thead>
<tr>
<th>Parameter [unit]</th>
<th>1st period</th>
<th>2nd period</th>
<th>3rd period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$N = 29$</td>
<td>$N = 29$</td>
<td>$N = 29$</td>
</tr>
<tr>
<td>$S_P_{VLF}$ [ms²]</td>
<td>60.57 ± 64.06</td>
<td>186.98 ± 102.85*</td>
<td>256.28 ± 152.53 †</td>
</tr>
<tr>
<td>$S_P_{LF}$ [ms²]</td>
<td>233.99 ± 150.72</td>
<td>353.34 ± 159.15*</td>
<td>531.50 ± 221.62 † §</td>
</tr>
<tr>
<td>$S_P_{HF}$ [ms²]</td>
<td>19.09 ± 12.65</td>
<td>31.97 ± 17.14*</td>
<td>49.21 ± 31.96 †</td>
</tr>
<tr>
<td>$S_P_{VLF}/P_{HF}$</td>
<td>3.62 ± 3.56</td>
<td>7.91 ± 7.36*</td>
<td>6.24 ± 4.62 †</td>
</tr>
<tr>
<td>$S_P_{LF}/P_{HF}$</td>
<td>13.38 ± 5.01</td>
<td>13.49 ± 7.79 NS</td>
<td>13.46 ± 6.85 NS</td>
</tr>
<tr>
<td>$S_P_T$ [ms²]</td>
<td>313.66 ± 206.97</td>
<td>572.28 ± 220.31*</td>
<td>836.99 ± 329.98 † §</td>
</tr>
<tr>
<td>$S_HR$ [BPM]</td>
<td>97.59 ± 7.16</td>
<td>84.11 ± 2.82*</td>
<td>79.19 ± 5.99 † §</td>
</tr>
<tr>
<td>$L_P_{VLF}$ [ms²]</td>
<td>310.02 ± 226.19</td>
<td>439.67 ± 275.00*</td>
<td>618.33 ± 428.00 †</td>
</tr>
<tr>
<td>$L_P_{LF}$ [ms²]</td>
<td>392.17 ± 242.73</td>
<td>480.77 ± 268.89 NS</td>
<td>939.86 ± 572.20 † §</td>
</tr>
<tr>
<td>$L_P_{HF}$ [ms²]</td>
<td>4,125.09 ± 1,371.29</td>
<td>4,389.80 ± 1,272.23 NS</td>
<td>3,966.05 ± 1,252.93 NS</td>
</tr>
<tr>
<td>$L_P_{VLF}/P_{HF}$</td>
<td>0.08 ± 0.07</td>
<td>0.11 ± 0.06*</td>
<td>0.16 ± 0.10 †</td>
</tr>
<tr>
<td>$L_P_{LF}/P_{HF}$</td>
<td>0.11 ± 0.08</td>
<td>0.12 ± 0.08 NS</td>
<td>0.25 ± 0.16 † §</td>
</tr>
<tr>
<td>$L_P_T$ [ms²]</td>
<td>12,920.14 ± 4,248.69</td>
<td>14,095.80 ± 3,865.08 NS</td>
<td>16,731.56 ± 5,620.09 † §</td>
</tr>
<tr>
<td>$L_HR$ [BPM]</td>
<td>51.18 ± 4.13</td>
<td>50.22 ± 2.52 NS</td>
<td>48.11 ± 4.06 † §</td>
</tr>
</tbody>
</table>

Legend: S – standing position, L – lying position, $P_{VLF}$ – power very low frequency, $P_{LF}$ – power low frequency, $P_{HF}$ – power high frequency, $P_T$ – total power, HR – heart rate, * – 1st period vs 2nd period, † – 1st period vs 3rd period, § – 2nd period vs 3rd period (Kruskal-Wallis $H$-test followed by Wilcoxon test), $P \leq .05$, NS – non significant, values are given as mean ±SE

### TABLE 4
Statistical analysis of investigated parameters during different convalescence period

<table>
<thead>
<tr>
<th>Parameter [unit]</th>
<th>1st period</th>
<th>2nd period</th>
<th>3rd period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$N = 29$</td>
<td>$N = 29$</td>
<td>$N = 29$</td>
</tr>
<tr>
<td>$TS$ [points]</td>
<td>0.83 ± 0.54</td>
<td>0.98 ± 0.44 NS</td>
<td>0.86 ± 0.55 NS</td>
</tr>
<tr>
<td>$VA$ [points]</td>
<td>0.52 ± 0.51</td>
<td>0.67 ± 0.38 NS</td>
<td>0.62 ± 0.53 NS</td>
</tr>
<tr>
<td>$SVB$ [points]</td>
<td>1.40 ± 0.85</td>
<td>1.57 ± 0.84 NS</td>
<td>1.31 ± 0.97 NS</td>
</tr>
<tr>
<td>Borg scale [points]</td>
<td>11.12 ± 2.71</td>
<td>13.31 ± 2.29*</td>
<td>14.69 ± 2.16 † §</td>
</tr>
<tr>
<td>Fatigue [points]</td>
<td>1.38 ± 0.94</td>
<td>1.59 ± 0.98 NS</td>
<td>2.10 ± 1.01 †</td>
</tr>
</tbody>
</table>

Legend: TS – complex index of total score, VA – complex index of vagal activity, SVB – complex index of sympathovagal balance, $P \leq .05$ (Kruskal-Wallis $H$-test followed by Wilcoxon test), NS – non significant, * – 1st period vs 2nd period, † – 1st period vs 3rd period, § – 2nd period vs 3rd period (ANOVA; Fischer LSD post hoc test), $P \leq .05$, NS – non significant, values are given as mean ±SE

### TABLE 5
Results of transaminase levels analysis during convalescence and after 3 months

<table>
<thead>
<tr>
<th>Marker [unit]</th>
<th>(RV)</th>
<th>19. 7. 2011</th>
<th>10. 8.</th>
<th>17. 8.</th>
<th>1. 9.</th>
<th>3. 10.</th>
<th>4. 12.</th>
<th>28. 3. 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALT [ukat L⁻¹]</td>
<td>(0.15–0.73)</td>
<td>1.10</td>
<td>0.83</td>
<td>0.76</td>
<td>0.83</td>
<td>1.35</td>
<td>1.21</td>
<td>0.76</td>
</tr>
<tr>
<td>AST [ukat L⁻¹]</td>
<td>(0.04–0.66)</td>
<td>0.59</td>
<td>0.55</td>
<td>0.44</td>
<td>0.50</td>
<td>0.64</td>
<td>0.76</td>
<td>0.50</td>
</tr>
<tr>
<td>GGT [ukat L⁻¹]</td>
<td>(0.14–0.84)</td>
<td>0.79</td>
<td>0.68</td>
<td>0.64</td>
<td>0.75</td>
<td>0.76</td>
<td>0.72</td>
<td>0.64</td>
</tr>
</tbody>
</table>

TABLE 6
Results of Pearson correlation analysis between selected variables (N = 87)

<table>
<thead>
<tr>
<th></th>
<th>TS</th>
<th>VA</th>
<th>SVB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Fatigue</td>
<td>-0.054</td>
<td>0.060</td>
<td>-0.154</td>
</tr>
</tbody>
</table>

Legend: TS – complex index of total score, VA – complex index of vagal activity, SVB – complex index of sympatovagal balance, $r_p$ – Pearson correlation

TABLE 5 shows that the values of ALT were classified as slightly elevated, AST as normal (except for one investigation). All values of GTT were indentified in normal range. An improvement in all parameters occurred after three moths of return to standard training exercise. No relationship between any complex index of SA HRV and morning fatigue was found.

DISCUSSION

The aim of this study was to design a convalescence program for elite athlete after IM which contributes to an improvement of his fitness level and with the safe return to play without relapse of the fundamental disease. Our strategy was based on the optimizing of training load according to the ANS activity by using SA HRV.

The analysis revealed an increase in mean of $P_T$ during both tested position resulting from the increase in ANS activity. A dynamics of parameter $P_{LF}$ which purely reflects vagal activity (Malik, 1995) shows that vagal activity increased in lying, but remained unchanged in supine position. Therefore an increase in $P_T$ was mainly induced by rising of spectral power in slow fluctuations area ($P_{VLF}$ and $P_{LF}$) which is under influence either of both branches of ANS (Task Force, 1996) or mostly by sympathetic activity (Malliani, Pagani, Lombardi, & Cerrutti, 1991). Significant elevation of ratio $P_{VLF}/P_{HF}$ and $P_{LF}/P_{HF}$ during subsequent periods of convalescence could be sign of relative increase in sympathetic activity despite persisted prevailing vagal activity in autonomic cardiac regulation during supine. These changes in autonomic regulation results from the continuously rising training load among periods when the last period was classified as the most intensive. In addition, in this period was investigated significant growth in perceived fatigue. In this context Furlan et al. (1993) reported that trained athletes during peak intensity training showed a resting bradycardia together with high LF values, thus suggesting a more complex neural interaction modulating HR. We suppose that mentioned changes in ANS activity in well trained athlete could be classified positively, because a short recovery will follow by withdrawal of elevated sympathetic activity accompanied with the increase in vagal activity.

Our results further show non-significant changes in index of SA HRV between particular convalescence periods which means only small complex changes in ANS activity. Stejskal, Šlachta, Elfmark, Salinger, and Gaul-Aláčová (2002) supposed that complex index of SA HRV are more sensitive for assessment of discrete changes ANS activity than individual spectral variables, because these indexes includes all age-dependent individual spectral parameters which were sampled in both standing, and supine position. A well-balanced state of ANS was reached via optimization of training load when each negative change in index of SA HRV was followed by the reduction in training load or temporarily interruption of training process. On the contrary, positive course of these indexes facilitated a more intensive training, and thereby an enhancement in physical fitness.

Noffsinger (1996) recommended that athletes for first few days of convalescence after IM should listen his or her body, and increase physical activities according to toleration. However, from the performed correlation analysis between ANS activity and morning fatigue in our study, it is evident that an athlete based on his subjective feelings is not able to assess his actual adaptation capacity. Nevertheless, the level of actual adaptation capacities plays an important role in adequate training load determination. Therefore, we inclined to opinion that self-perception of fatigue could be use as a tool for training load determination only in the few first days of convalescence after long lasting disease. However, long-term determination of the training load based on feeling of fatigue could be in this sense a misguided.

An investigation of functional state or size of liver and spleen could be helpful in determination of time frame of the return to play (Putukian et al., 2008; Waninger & Harcke, 2005). In our study, we investigated a border line or mild elevated values of ALT (AST only in one measurement) while liver and spleen had, according to a medical report normal size. From review of Waninger and Harcke (2005) results that there has been no definitive correlation identified between an increase in of the spleen and blood liver/enzyme parameters, and further, no data support the use of serial hematological studies as an indicator of safety return to play. Therefore, we suppose that in given case the dynamics of liver enzymes did not indicate an excessive increase in training load during convalescence periods.
In our study we further found successive decline in HR in supine and mostly in orthostatic stimulation. It is evident that this HR dynamics could be considered as a sign of new adaptation development. Because, two months of training interruption caused detraining which is associated with the partial or complete loss of training-induced anatomical, physiological and performance adaptations (Mujika & Padilla, 2001). From dynamics of HR is evident that a time course of cardiovascular adaptation could be controlled both in supine, and during orthostatic stimulation.

Limitations

An absence of control patient group together with only case study report could be considered the main limitation of this study. More research in this field is needed.

CONCLUSIONS

Our study shows that convalescence strategy based on assessment of ANS activity contributed an improvement in physical fitness, in spite of borderline or mild elevated transaminase level. Probably training guided by subjective feeling of fatigue within convalescence after IM could be inaccurate. In conclusion, we suggest that combination of both non-invasive SA HRV method and periodical assessment of biochemical indicators of liver state seems to be a promising strategy for determination of safe application of the training load during convalescence after IM. Finally, SA HRV can be accepted as an auxiliary method in infectious hepatitis patients with borderline biochemical parameters.

ACKNOWLEDGEMENTS

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Cíle: Hlavním cílem naší práce bylo vytvořit opti- 
mální rekondiční program pro vrcholového sportovce po recidivě InM, který povede k jeho bezpečnému ná- 
vratu do vrcholového sportu.

Metodika: Řízená rekonzilence trvala téměř 
tři měsíce. Dávkování zatížení bylo podřízeno aktuální 
úrovní aktivity autonomního nervového systému (ANS), 
která byla opakovaně diagnostikována metodou spektrál-
ní analýzy variabilita srdční frekvence (SA VSF). Hod-
noceny byly individuální parametry – spektrální výkon 
v oblasti velmi nízké frekvence (P_{VLF} (0,02–0,05 Hz); 
yký v oblasti nízké frekvence (P_{LF} (0,05–0,15 Hz); 
yký v oblasti vysoké frekvence (P_{HF} (0,15–0,50 Hz); 
celkový spektrální výkon (P_{T}) (0,02–0,50 Hz); poměr 
P_{VLF}/P_{HF} a P_{LF}/P_{HF} a srdční frekvence (SF). Dále byla 
aktivita ANS posuzována pomocí komplexních indexů 
SA HRV – indexu vagové aktivity, sympatovagové balan-
ce a celkového skóre. V práci bylo hodnoceno i subjek-
tivní vnímání zatížení společně s ranní únavou. Prová-
děny byly také biochemické analýzy aktivity vybraných 
jaterních enzymů.

Výsledky: Během rekonzilence došlo k zvý-
šení průměrné hodnoty P_{T}, které doprovázelo zvýšení 
poměru P_{VLF}/P_{HF} a P_{LF}/P_{HF}. Mezi jednotlivými etapa-
mi rekonzilence nedošlo k signifikantním změnám 
u žádném z komplexních indexů SA HRV. V lehu a pře-
devším ve stoji byl zaznamenán signifikantní pokles SF. 
Dále byl během rekonzilence pozorován signifikant-
ní vzestup subjektivní vnímání zatížení a v poslední 
etapě došlo ke kulminaci ranní únavy. Mezi komplexní-
i indexy SA HRV a pocitem ranní únavy nebyl proká-
zán žádný vztah.

Závěry: Rekonzilence řízená na základě mo-
nitoringu aktivity ANS přispěla ke zlepšení kondice, 
průtože aktiva jaterních enzymů zůstávala hranicí až mírně zvýšená. Dávkování zatížení založené na sub-
jectivním hodnocení únavy v rámci rekonzilence po 
InM bude pravděpodobně nepřesné. Proto se domní-
váme, že neinvazivní metoda SA VSF společně s pravi-
delnou biochemickou analýzou jaterních enzymů se zdá 
být sílnou strategii pro stanovení bezpečného zatížení 
během rekonzilence po InM, která povede k návratu 
sportovce do plného zatížení.

Klíčová slova: variabilita srdční frekvence, únavy, hepatis-
tida, Epstein-Barr vírus, detrénink, rekonzilence.
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Education and previous work experience
Since 2007 – Institute of Active Lifestyle (Center of Kinanthropology Research), Faculty of Physical Culture, Palacký University, Olomouc.
2008 – Doctoral degree – PhDr. (Philosophy), Faculty of Physical Culture, Palacký University, Olomouc.
2007 – Doctoral degree – Ph.D. (Kinanthropology), Faculty of Physical Culture, Palacký University, Olomouc.
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Scientific orientation
Exercise physiology and its application into the sport events, main research objects: assessment of autonomic nervous system activity by spectral analysis of heart rate variability and its using in various areas for instance: simulated altitude; training dose optimalization; talent identification in sport; quantification of fatigue; jet lag syndrome problematic and/or vagal threshold determination.

First-line publications