

The influence of the running preparation on the aerobic and anaerobic threshold in a year's training cycle at the cross triathlete

Authors' Contribution:

A - Study Design
B - Data Collection
C - Statistical Analysis
D - Manuscript Preparation
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Abstract

Triathlon is developing very quickly nowadays. In our paper we are interested in cross triathlon. The road bike is replaced by the mtb mountain bike and the run is also done in the mountain. Triathlon is the endurance kind of sport where the AeT's (aerobical threshold) and AnT's (anaerobical threshold) level is the basic indicator of a sports performance. The curve of the both thresholds changes under the influence of a lot of factors during the year. We studied the influence of the running preparation on the aerobic and anaerobic threshold at the cross triathlon specialist during one year. We monitored the level, especially the changes in the sports performance during the ATC (annual training cycle). We valued the training process, the quantization of the training load and its influence on the triathlete's performance with the intraindividual analysis. We gained the necessary data from the training diary and with help of the tests realized in the laboratory conditions. We detected the speed at the aerobic and anaerobic threshold by the running belt. Then we correlated them with the training parameters and we found out the addition. We followed their actual influence on the performance and the influence of the training parameters in the time intervals.

Key words: triathlon, running preparation, aerobic threshold, anaerobic threshold

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INTRODUCTON

The basic of the training is fixing on the quantization of the intensity and the volume of the load with the cyclical stimul. These stimul activate the complexing adaptation of the organism and its move our performance upwards [1].

As in most endurance sports, development of basic endurance (BE) is essential also for cross triathlon and it represents 60 – 85% of the total training volume. Basic endurance zone comprises 75 – 85% of the individual maximum, i.e. aerobic metabolism. Continuous training methods are considered to be the most appropriate ones [2].

Basic endurance zone is interconnected with the aero-anaerobic zone, i.e. special race endurance which ranges from 85% up to 95% of the individual speed maximum. It covers 10 – 25% of the training plan. To develop basic endurance, the continuous intensive and alternating methods as well as an extensive form of the interval method are used. The development of the special endurance is giving the achieved level of the basic endurance according to a lot of authors [2,3,4,5].

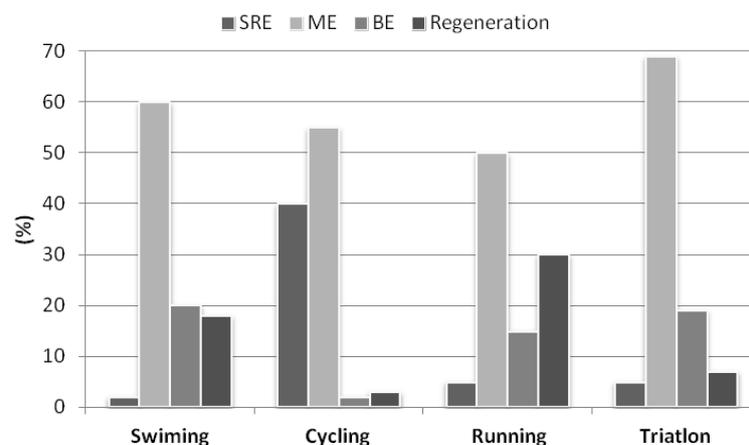


Figure 1. Influence of the Individual Speed Skills in the Endurance Sports in the Triathlon [19]
SRE – special race endurance, ME – medium endurance, BE – basic endurance

Performance athletes have the most part of the training volume in the basic endurance zone (60%). The medium to high intensity performance 20% from the total volume (fig. 1). The training of the special race endurance performance the less percent in the training load [2]. The results of Krajčovič [6,7] say that the endurance is portable feature. There is the transfer of the aerobic – anaerobical zone between the individual triathlon disciplines. The running training indicators conditioned the changes of the sports performance in the swimming. That is interesting in triathlon. And the swimming and running training indicators conditioned/manifested in the cycling performance.

Physiological values of triathletes in all disciplines are very similar to those of the athletes who practice only one of the triathlon disciplines, whilst they have to divide their time among three different disciplines. Physiological predispositions of triathletes are particularly similar to those of cyclists and athletes-runners thanks to the cross trainings (swimming – cycling, cycling – running), i.e. the transition training. However, it does not affect the swimming discipline. With regards to these findings, triathletes are recommended to benefit from cross/combined trainings [8,9,10,11,12].

Krajčovič [11] was interested in the influence of the athletic preparation on triathlon and on its other two disciplines. The athletics preparation in the triathlon has its specifics in the percentage of the individual training zones. The positive transfer of the running preparation

manifested in the mixed zone (aerobic-anaerobical zone) in both disciplines (swimming, cycling).

The time adaptation effect of the athletics preparation on the sports performance is differentiated from the point of view of the individual disciplines. The efficiency of the training load in swimming significantly demonstrated on the sports performance in the individual disciplines and in triathlon too with the time shift/lag of twelve weeks at triathlete P. P. during the three year's training cycles.

There is the predominance of the mixed training zones (race pace/aerobic-anaerobical zones) in the casual relationship to the changes of the sports performance at the athlete, M.T. These training indicators show more positive relationship in the most time shifts compared with the other training parameters. The parameters in the speeder training zones have the influence to the changes of the sports performance with the short-term time shift. The zones characterised with the lower rate have the influence with the more long-term time shift [13]. Vavák was interested in the intraindividual following of the racewalking with the help the time series [14]. The influence of the training indicators of the lower zones shows with more lag of like the effect of the training indicators of the faster zones. The specific training parameters affect/influence to the sports performance in the phase of immediate preparation during the lowering/minimizing the volume and raising the intensity of the training load at the last nine weeks. Vavák showed the lower statistics significance of the running indicators on the sports performance (endurance in the speed, tempo endurance, balanced endurance [15]. The values had the negative character. The acceleration and maximum speed had the higher influence from the results.

METHODS

Participant

The subject represents Slovakia in cross and winter triathlon. He regularly takes part in the races of international importance (World and European Championship) as well as in the national races in sprint, Olympic and half-ironman types of tracks. He began his career in sports as a swimmer in Žilina swimming club – Nereus Žilina. This club participated in the formation of the triathlon club under the same name. Their swimming coach was P.F. As a swimmer, he has excellent fundamentals for triathlon.

T.J., born in 1983, is 179 cm tall with an average weight of 74 kg. He has been a triathlete since he was 13 years old. Physiological parameters of this competitor are: VO_2 max 78.8 ml/kg/min, HR max 184, HR AeT 138 ± 2 and HR AnT 171. As mentioned above, he represents swimming and triathlon club Nereus Žilina. He prepares his own training plan. He trains with his training group which is under his professional guidance. During winter training, he cooperates with M.S., an athletics coach and a national coach for winter triathlon and cross triathlon from Banská Bystrica.

T.J. won the Slovak Championship 2011 in winter triathlon. He came in second place at the Slovak Championship 2011 in cross triathlon. He is the Champion of Slovakia 2012 in winter as well as cross triathlon. In 2012, he came in third place at the Winter Triathlon European Cup in Switzerland and in fourth place in Estonia. He came in seventh place at the Winter Triathlon World Championship, but due to technical reasons he could not finish the race at the Winter Triathlon European Championship. He finished eighth at the Cross Triathlon European Championship (the Hague, the Netherlands).

Measures and procedures

To evaluate the data, we used the method of training log assessment, more precisely, we assessed the triathlete's 2011/2012 training log. In order to collect information about the training load in particular bio-energetic H1 – H3 zones, the GARMIN system was employed.

When specifying the training methods, we respected the basic condition of equidistant numerical data regarding the quantitative and qualitative aspects of the training load during individual periods in relation to the conditions underlying the methods used for data processing and evaluation.

Our research had an intra-individual character and was carried out "ex post facto". The subject was a cross triathlete ("V₁"). The condition were the physiological parameters. Its characterized the level of the aerobic and anaerobic threshold. The researching situation is bounded the annual training cycle 2011/2012 from the time of view "Dt". The following period " $\Delta t_0 - \Delta t_{13}$ " is consist from the 13 mesocycles. One mesocycle is four weeks. The suggestions „P₁, ... P₂₁“ are formed the general and specific indicators of the training load.

Objectives:

1. to determine the dynamics of the load training methods and the changes in the physiological parameters during the ATC.
2. to highlight the impact of the load training to the dynamics of the changes in physiological parameters during the ATC.

RESULTS

We focused to follow the dynamics of the training load and the causality of the special training parameters (running) to the changes of the level of the physiological threshold (AeT, AnT) during 13 months, annual training cycle. We showed the positive or negative polarity of the relationship with the correlation and regression analyses of the time series. The results are subjected substantive and logical analysis and our experiences.

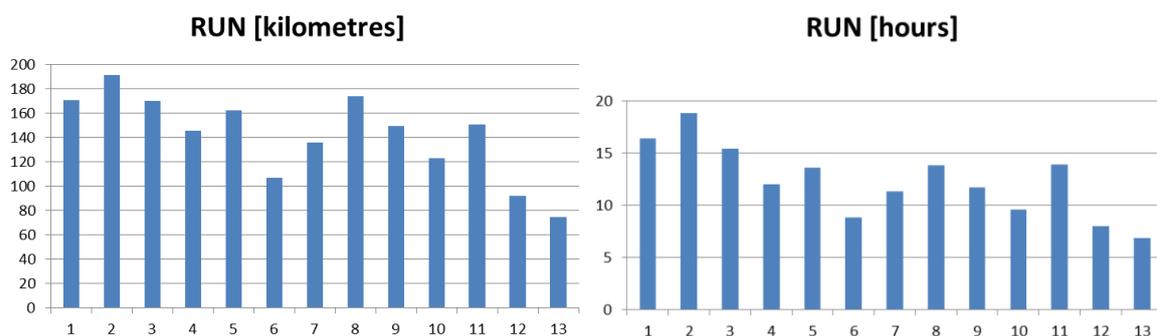


Figure 2. Volume of the Running Preparation in Kilometres and Hours During the Annual Training Cycle

The running preparation is the most balanced factor of the influence of the view the kilometers and hours indicators (fig. 2). The lower decreases are during the transitional period after the race part of the season in the winter and in the summer. The aerobic base is being built similarly before the peak of each season. It is only four months during the summer season. Differences can be observed in the other two zones.

Changes in the subject's AeT and AnT that occurred during the ATC were the results of the observed training parameters impact (Table 2), especially volume parameters in the individual training zones.

During the season 2011/2012 the subject took part in Cross Triathlon European Championship and in Winter Triathlon World Championship. He also participated in various races of European Triathlon Cup. It follows that during 2011/2012 ATC the subject had planned a two-peak season with the first peak in March (the seventh mesocycle) and the second peak in July (the eleventh to the twelfth mesocycle).

In our research, we took the subject's anaerobic and anaerobical threshold for his current performance level. As seen in Figures 3, the both curves have a sinusoidal character. When the curve of aerobic threshold increase, the curve of anaerobical threshold decrease and counter.

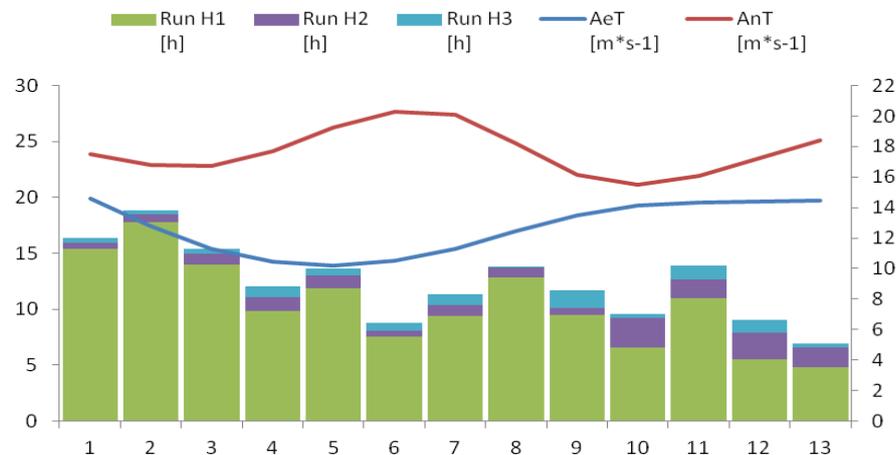


Figure 3. Dynamics of the Volume of the Load of the Specific Training Running Parameters [h = hours] and the Curve of the Aerobic Threshold (AeT) and Anaerobical Threshold (AnT) During the Annual Training Cycle 2011/2012

The aerobic base is being built similarly before the peak of each season. It is only four months during the summer season. Differences can be observed in the other two zones (fig. 3). In the summer training, the subject adapted to the racing pace a month before the peak of the season – the highest volume parameters; in the following mesocycle, there was a decrease of the volume parameters. In the winter training, the curve AnT had an inverse character two to three months before the peak of the season, the subject's plan included more volume parameters in the aerobic zone.

As for the increase of the AeT level, the winter training sessions and the winter training plan were more efficacious before the first peak of the season. We observed the increase of the curve AnT with the decrease of the load volume. This increase is observable in the summer part of the preparation, resp. the increase was late in the view to the peak of the season (fig. 3). The curve of AeT doesn't decrease but it stays relatively high. We can see the differences between summer and winter part of the preparation in the zone H2 and H3. There is significant share of the zone H2 one month before the peak in the summer (tenth mesocycle). The share load in the zone H3 is stronger in the summer's part again, two months before the peak of the season (ninth mesocycle).

The curve AnT should grow to the second maximum more quickly in the second part of the season in the jule – august (11, 12 mesocycle). The winter preparation seems better in terms of both curves. The zone H1 operate on the AnT with reverse polarity like on the AeT lagged by zero, one, two and five mesocycle. It is the same in the zone H2. The volume of running load in the H2 zone lagged by zero and first mesocycle. The volume of running load in the H3 zone is oppositely polarized lagged by zero, six and seven mesocycle ($p < 0.20$).

All running preparation operate on the AnT with immediate effect (lagged by zero mesocycle) and with with a medium shift (lagged by five mesocycle) without the zone H3. Running like a negative factor operate the sport's performance with the short shift lagged by one mesocycle (tab. 1). All running preparation has the positive influence on the curve AeT without the zone H3 lagged by one mesocycle (short shift). There is the negative influence on the AeT lagged by zero and five mesocycle.

Table 1. Pair Correlations of Special Training Running Indicators [h = hours] and Speed Changes in Aerobical Threshold (AeT) and Anaerobical Threshold (AnT)

		Time log (1 log = 4-week mesocycle)									
		0	1	2	3	4	5	6	7	8	
AeT	Run [km]	*	***				*				
	Run [h]	*	**				*				
	Run H1 [h]	*	****	*			*				
	Run H2 [h]	****	***								
	Run H3 [h]	*						*	***		
AT	Run [km]	*	***			**	***	*			
	Run [h]		**			*	***	*			
	Run H1 [h]	*	***	*		*	***	*			
	Run H2 [h]	****	***			*					
	Run H3 [h]	*	*					*	***		

Key	$p < 0.20$	$p < 0.10$	$p < 0.05$	$p < 0.01$
Positive level of significance	*	**	***	****
Negative level of significance	*	**	***	****

DISCUSSION

A lot of authors [16,17] were interested in the problems about the Dynamics of the training load during the annual training cycle in triathlon. Some of them generalized their results. New researches show to need the intraindividual analyses [5,6,7,15,18,19,20,21].

The most important physiological parameters there are the level of the heart rate (n), speed ($m \cdot s^{-1}$), lactate ($mmol \cdot l^{-1}$), load (W), VO_{2max} . Its reflect the influence of the endurance training on the Dynamics changes of the aerobical and anaerobical thresholds. The speed of the running is the most stable characteristics from all parametres which determined the actual level of two thresholds.

This characteristics is the least dependant from the internal and external manifestation of the organism. The running speed and the heart rate are the important parameters in the management system of the training proces [7,17,21].

Many reserchers [1,22,23,24,25,26,27,28] show on the adaptation effect of the physiological parameters in time from aerobical and anaerobical load.

CONCLUSION

Our results show that the running preparation T.J., it is relatively well managed and has a significant impact on changes in AeT and AnT during ATC. But we must take into account the swimming and cycling training, which also share the physiological thresholds during the annual preparation of the triathlete.

The influence of the volume parameters was reflected lagged by one mesocycle to AeT, but the four-month and six month apart. So running volume of 4 to 6 months for peak season and calming one week before the peak just have a positive impact on the aerobical threshold.

Interestingly, volume indicators have a positive impact on the AnT with immediate effect. Perhaps the rest of the proband had a beneficial effect and positive increase of the AnT. Also, volume indicators had positive influence on the anaerobical threshold lagged by five mesocycle.

None of fast zones (H2, H3) did not affect the AnT. In the future, we would recommend to the proband to focus precisely on those areas that should be a major factor for change AnT.

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