

INTENSITY RATIO AND DURATION PARAMETERS IN THE TRAINING OF RUNNERS WITH DIFFERENT QUALIFICATIONS

Original scientific paper

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Abstract

Endurance training includes workloads whose basic parameters are intensity, duration and recreation intervals. A condition for success is the skillful combination of these parameters in the different training cycles, so that according to the sporting experience, qualification, objectives, to be influenced the adaptive capabilities. The approximate ratio of 80/20 (low intensity to high intensity) is valid for elite athletes. Amateur athletes, however, often train more around and above the lactate threshold. The pursuit of short-term effect is the reason of intensification, but it often leads to over-training, traumatism and other negative consequences.

Keywords: *high intensity training (HIT), low intensity, adaptation, elite, non-elite athletes*

INTRODUCTION

The relative impact of short-term high-intensity workloads and slow, long-term workouts are the subject of long-standing discussion by scientists, coaches, athletes. Numerous studies have shown that elite athletes perform about 80% job training for endurance below the lactate threshold and carry out activities with high intensity extremely carefully (Seiler, & Tonnessen, 2009; Fiskerstrand, & Seiler, 2004; Billat, Flechet, Petit, Muriaux, & Koralsztein, 1999).

Large volumes of low intensity work and the cautious application of speed training in the annual cycle are the most appropriate model for endurance development, according to contemporary scientific comprehensions (Seiler, & Tonnessen, 2009).

The question to be discussed is how to reflect the speed loads of beginner or amateur athletes?

However, without comprehensive knowledge about the physiology of effective training, professionals and athletes need to have a sense of how changes in training influences affect health. Knowing the body's tolerance to certain workloads will make training more effective. Successful athletes over time and based on his experience training so as to get the big adaptive benefit. This feedback over the time will lead to maximum training effect and minimal risk of traumatism and precariousness.

METHODS

Objective of the study

This present study aims to examine the impact of varying intensity and duration loads runners - amateurs. Literary sources have been analyzed on the impact of high intensity and low intensity training on athletes training sport for stamina, trends of the past and present have been highlighted.

Study sample

For the purpose of the experiment tested 20 amateur athletes - men who run actively.

Methodology

It has been made a review of literary sources, the application of intensity and duration of effort, as the main components of the endurance training. Sports-pedagogical testing was conducted. Mathematical and statistical methods were used - variation and dispersion analysis.

RESULTS AND DISCUSSION

Some modern studies of untrained and less trained athletes indicate that 2-3 intensive workouts a week, even for 6-8 weeks, can lead to serious metabolic changes (Helgerud et al., 2009).

The study by Seiler & Tonnessen (2009) includes a comprehensive empirical study using data from sports diaries and more than 15,000 Classes. Three world and Olympic champions are tracked in three sports - long runs, orientation and skating. Common between athletes is that their long sporting career approximately 85% of the training sessions are performed with low intensity (lactate below 2 mmol / l).

Back in the 1920s, the Nobel Prize laureate, physiologist Archibald Hill, found a link between oxygen consumption of muscle tissue and lactic acid metabolism (lactate). He includes in his studies exercises with interruptions, which he considers an interval ideologist. The special term "interval training" was first used by German coach Geschler (Waldemar Gerschler) and physiologist Dr. Herbert Reindel of the University of Freiburg. In the "original" their occupation provides for a 30-70 second bevel effort, with a pulse rate of 170-180 HR and a subsequent rest of 1.30 minutes to lower the pulse rate to 120 hr. Training ends when the athlete cannot restore his pulse as described above. The two scientists believe that the alternation of hard work and recovery provides an adaptive stimulus to the heart.

In the 30s of the last century, Swedish coach Gosta Holmer presented "fartlek" as a variation of interval training. The initial essence of this type of exercise is for the athlete to change the speed repeatedly, following his feelings. Indisputable advantages of "fartlek" - further developed and refined subsequently as a model are still relevant in modern times.

Kind of stimulus in the development of intensive training gives the great Czech Emil Zatopek - the athlete that is unsurpassed in the long run in the middle of the 20th century. His training methods consist of carrying out a huge amount of repetitions of segments under different conditions and on various terrains.

In its essence, however, these activities Czech athlete affects mostly on the aerobic system, given low on intensity of similar long training exercise. Over the years, more and more scientists have begun to conduct research, analyze, and change the views of interval training.

In the 1960s, Swedish scientists, headed by Per-Olof Astrand, conducted innovative research into the effects of prolonged work and rest on physiological responses (Astrand, Astrand, Christensen, & Hedman, 1960).

Mc Dougall and Sall (1981) published one of the first surveillance studies that compared the effect of continuous with that of high-intensity impacts. According to these scientists, both training forms are very important for a variety of reasons. HIT (High Intensity Training) strongly influences to the peripheral changes.

Table 1: Example three-zone model for endurance athlete training

Intensity zone	VO2 (%max)	Heart rate (%max)	Lactate (mmol/l)	
1	50-75	55-75	1-2	LIT (low intensity training)
2	75-85	75-90	2-4	ThT (threshold training)
3	85-100	90-100	6-10	HIT (high intensity training)

In the last decade of the last century, studies began to be published that set the mythologized high-intensity interval training to a test.

In 1985, Poole and Gaesser conducted an eight-week study of three groups of people with a low level of training. Each of the groups performs work of varying intensity three times a week - one 55 min to 50% of the VO2 max (maximum oxygen consumption), the second one - 35 min to 75% and the third to 10x2 min to 105% for 2 min recreation. No significant increases in the VO2 max. Of all three groups have been reported since the end of the experiment.

In direct comparison with low to high intensity loads qualified runners Acevedo & Goldfarb (1989) only 2% improvement in performance of 10 km and maximum test on a treadmill, after a three workouts a week with intensity 90-95% of VO2 max. However, the lactate threshold was increased.

In another study (Billat, et al., 1999), they studied medium and long distance runners and found that a regime of 4 low-intensity + 1 HIT +1 threshold training (around the lactate threshold) in the weekly cycle improved the pace of running at the VO2 max. Level as and economy. At the same time, in 2 low-intensity + 3 HIT + 1 threshold, no adaptive changes were observed, but subjectively increased the training stress and there were signs of pretraining.

Zones of Intensity

Short-term periodization, including daily manipulation of intensity and duration (over several weeks), is better studied than in the long-term. World elite athletes train, rest and repeat the same. Training - intensity and duration, and recovery (breaks and feeding intervals) interact to cause physiological adaptations as well as fatigue (stress and related health consequences. Elite athletes train two, sometimes three times a day. Extracting useful result of such loads, without accumulation of excessive stress, requires careful management of the training process.

Changes in physiological capacity over time suggests that the result of the impact of alternating load and recovery.

The most common is the concept of using a heart rate-based intensity scale of the maximum and typical blood lactate concen-

trations. More recent studies have given priority to dividing zones based on a ventilator threshold (Beneke, & von Duvillard, 1996; Beneke, Leithauser., & Hutler, 2001).

In scientific publications most common are models using five and three zones, these zones are somewhat arbitrary. Table 1 shows exemplary model with three zones.

5 workouts - low intensity running with heart rate up to 150 rpm (LIT)

Activities can be held on a variety of terrain - athletics track, trail, road.

The persons register each of their workouts in a mobile application for better control. At the beginning and at the end of the experiment, the two groups were tested by two tests - 5000 m and 1000 m, with the aim to observe the impact of the different stresses on the endurance.

The sample of surveyed persons is representative, which implies a probability in making statistical decisions. When calculating the experimental results using the variance analysis, the following data were obtained in the initial and final tests (Table 2).

The processed results show that the first group has a significantly better mean than the second one at 5000 m (by 1.28 minutes) at the beginning, and on the test 1000 m the mean time is almost equal. The second group at the start of the research has a coefficient of variation V = 13.33, which indicates an approximately homogeneous sample. At the end of the experiment, the difference in the mean times of the two groups decreased to 1.17 min. On the 1000m test at the first run for both groups there is almost no difference in average times. However, at the final run of 1000 m, a difference of 11 seconds was recorded in favour of the first group (which works with higher intensity).

Tables 3 and 4 presents the within-subject and between-subject interactions. From the statistical point of view, the following results were obtained for the credibility of differences and "start-end" changes:

Only in the 1000 m test of the first group test has a maximum guarantee probability of 100% (P = 100), which indicates a realized growth, which is statistically reliable. From a practical point of view, a 17-second increment for the 5000 m test is serious, but is shown 91,7% guarantee probability. The second group, due to the applied impact, has a significant increase - 28 seconds per 5000 m, and 1000 m - insignificant regression (2 sec).

From the analysis we can see that just in 1000 m test, the group that exercises with higher intensity (group 1) has a statistically significant increase.

Table 2. Data from variance analysis in the "start" and "end" of the experiment for the two groups

test	1-st group			V	2-nd group			V
	X min	X max	□		X min	X max	□	
5000 m beginning	17,50	23,10	20,17	8,94	17,50	23,20	21,45	13,33
5000 m end	17,50	21,56	20,00	7,88	18,20	23,40	21,17	8,25
1000 m beginning	3,05	3,48	3,24	7,72	3,09	3,56	3,27	7,82
1000 m end	3,01	3,40	3,18	6,85	3,15	3,55	3,29	6,13

Table 3. "Within-subjects" and "between-subjects" interaction for 5000m test

5000 m group	beginning		end		D	α	t	P(t)
	□ b	S b	□ e	S e				
1-st	20,17	1,48	20,00	1,34	-0,17	0,083	1,95	91,7
2-nd	21,45	1,34	21,17	1,45	-0,28	0,373	0,94	62,7
d		0,28		1,17				
α		0,189		0,103				
t		-1,366		-1,718				
P(t)		81,1		89,70				

Table 4. "Within-subjects" and "between-subjects" interaction for 1000m test

1000 m group	beginning		end		D	α	t	P(t)
	\square b	S b	\square e	S e				
1-st	3,24	0,15	3,18	0,14	-0,6	0,000	7,13	100
2-nd	3,27	0,16	3,29	0,13	0,2	0,465	-0,78	53,5
d		0,03		0,11				
α		0,660		0,080				
t		-0,447		1,855				
P(t)		34,0		92,0				

CONCLUSIONS

In today's sports science, there are still controversial views on how intensive and how long to train the athletes for endurance.

From the review of literary sources, it is suggested that „80%: 20%“- „low: high“ intensity leads to better long-term results. Slow running (up to 2 mmol / l lactate in the blood), longer training, effectively stimulate physiological adaptation. Athletes that have a good base for endurance and adaptation to relatively high workloads, intensification can contribute to a small increase.

The research is among amateur sportsmen. In the final study, the assumption has not been confirmed that the results in both tests of running only in the aerobic zone will increase.

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