Features of training programs of highly qualified athletes in cyclic disciplines, where the duration of competitive activity exceeds 6 minutes

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Abstract

Objective of the study – is to establish the characteristics of the training work of the world's leading athletes specializing in sports disciplines where cyclical movements prevail and endurance is required.

Methods and structure of the study. The research methods used were the collection, systematization and analysis of materials from foreign scientific papers extracted from the information and reference resources Google Scholar and PubMed. This article presents the characteristics of the training load of highly qualified athletes practicing cyclical sports. The distribution of training loads by intensity levels is described. The percentage contribution of training conducted in each of the intensity zones to the total annual training cycle for various sports disciplines is reflected. The main training tools used by elite athletes in each of the intensity zones are analyzed.

Results and conclusions. For outstanding athletes competing in cyclical sports lasting more than six minutes, the total training time in the first intensity zone is 75-80% of the total training load during the one-year training cycle. 10-15% of training sessions are conducted in the moderate intensity zone. High-class athletes perform approximately 5-10% of the total annual volume with high intensity.

Keywords: *training work, world athletes, sports disciplines, cyclic movements, endurance, training load, highly qualified athletes, intensity.*

Introduction. The results of numerous scientific studies show that the amount of training loads for elite athletes in cyclic sports, the result of which depends on the level of endurance development, is in the range of 500-1200 hours per year when athletes perform 300-500 training sessions [1-5]. Experts explain the significant difference in the amount of training load by the peculiarities of sports in which the load on the musculoskeletal system is characterized by significant differences due to movement in different environments and on different surfaces, as well as the use of various sports equipment. To understand the general patterns of building training programs in cyclical sports and to better understand the specifics of training in individual sports, it is necessary to summarize data on the training process of elite athletes.

Objective of the study – is to establish the characteristics of the training work of the world's leading athletes specializing in sports disciplines where cyclical movements prevail and endurance is required.

Methods and structure of the study. The materials of foreign studies devoted to the problems of athletes' training in endurance sports, obtained from the reference databases Google Scholar and PubMed, were collected, summarized and studied.

Results and conclusions. Based on a survey of twelve successful Norwegian male coaches who work with athletes in sports with a cyclical nature of athletic movements and who have trained a total of more than a hundred winners and prize-winners of major international competitions, as well as generalizing data from scientific publications [1-6, 8], a group of foreign experts developed a general description of the training load in these sports sports (Table 1).

Table 1. Characteristics of the training load of elite athletes in sports with a cyclical nature of athletic movements and a duration of competitive exercise of more than 6 minutes in the annual training cycle [7]

Sport	Number of hours per year	Training sessions per year	Competitions per year	Intensive training per year	% of specific workouts
Biathlon	800–1000	500–575	30–40	100–120	>60
Ski racing	900–1100	525–575	30–40	100–120	>60
Long-distance running	600–700	550–625	20–35	110–140	>90
Bike trail	1000–1200	300–350	50–80	110–130	>90
Rowing	850–1000	475–525	25–35	100–125	>60
Skates	900–1100	500–575	25–35	120–140	>15
Swimming	1150–1350	650–700	20–30	130–150	>70

Swimmers spend the most time on training in the annual training cycle. The least are long–distance runners. This is because you can exercise more in an aquatic environment. The training time of runners is limited by the heavy load on the musculoskeletal system due to the impact interaction with the support. Road cyclists have the least amount of training per year. This is partly due to the fact that these athletes are almost twice as likely to participate in competitions.

Cross-training, (cross-training) or the use of endurance training tools in a non-specific mode borrowed from other sports makes up a significant part of low-intensity training in several sports. For example, cycling for speed skaters or running for skiers. Treadmill running is considered a specific exercise (i.e., not cross-training) for runners, roller skiing for skiers, roller skating for speed skaters, ergometer rowing for rowers, and indoor cycling for cyclists [7].

A six-zone scale developed by the Norwegian Top Sport Centre is currently used to assess the intensity of endurance training (Table 2).

The distribution of training loads by intensity zones in the annual training cycle, typical for elite athletes specializing in cyclical sports, is shown in Table 3.

In general, the volume of training load in low-intensity zones is approximately 75-80% of the total annual volume. The workouts performed in this area are dominated by exercises performed in a continuous mode. At the same time, low-intensity interval training is also used in road cycling, swimming, rowing and speed skating. The athletes presented in the table. They perform the vast majority of low–intensity workouts in the first zone and, to a lesser extent, in the second. Elite athletes, depending on their sport, usually perform a training load in the first zone over a wide time range – from 40 to 400 minutes. Long–distance runners have the shortest workout, while cyclists have the longest. Athletes in long-distance running, road cycling and swimming use mainly a specific load in the low-intensity zone. Non-specific cross-training is often used in speed skating, rowing, biathlon, and cross-country skiing.

Table 2. Intensity scale for the analysis of training loads of elite athletes in sports with cyclical nature of athletic movements and duration of more than 6 minutes [7]

The scale		ЧСС	VO_2	BLa	RPEBorg
6-zone	3-zone	% from max	% of max	(mmol/L)	6–20
6	HIT	-	-	> 10	18–20
5	HIT	> 93	94–100	6.0–10.0	18–19
4	HIT	88–92	88–93	4.0–6.0	17–18
3	MIT	83–87	81–87	2.5–4.0	15–16
2	LIT	73–82	66–80	1.5–2.5	13–14
1	LIT	60–72	50–65	< 1,5	10–12

Note: BLa – normative ranges of lactate concentration in the blood based on the lysed erythrocyte mass; RPE – rating of perceived load based on the Borg scale 6-20; HIT – high-intensity training; MIT – moderate-intensity training; LIT – low-intensity training.

Table 3. Total training load time in each of the training load intensity zones of elite athletes in cyclic sports with a duration of competitive exercise of more than 6 minutes

Type of sport	Intensity zones					
	1	2	3	4	5	6
Biathlon	60–240	15–45*	30–65	20–40	15–25	5–10
Ski racing	60–240	15–45*	40–65	20–40	15–25	5–12
Long-distance running	30–105	5–30 *	20–40	15–35	10–20	3–6
Road cycling	120–420	20–60	45–60	20–50	10–30	4–8
Rowing	60–240	60–80	45–80	30–50	20–40	7–10
Skates	60–300	50–60	45–75	25–40	20–30	6–12
Swimming	60–150	40–80	45–70	25–40	12–20	4–15

*Note – * training only in the second zone is rarely used, but training conducted over a long distance and performed at a low speed may include the work of the 2nd zone to improve technique or to move over rough terrain.*

The training loads of the third zone of medium intensity account for approximately 10-15% of all the loads of the annual training cycle. These loads are mainly performed in the form of interval training. The total load time in this zone averages 20-90 minutes. The duration of one interval varies from 5 to 20 minutes. The work-to-rest ratio is mostly in the 5 range.:1. In a number of sports, the duration of training in the third zone is 0.7-1 hour. In some sports, especially in road cycling, the competitive load makes up a significant part of the total volume performed in the third zone.

Training loads related to the high intensity zone account for about 5-10% of the total annual volume. Most interval training is performed in this area. Competitions in most disciplines of endurance sports are also held in this zone. The accumulated training load time in the fourth zone in one workout is in the range of 12 and 45 minutes, from 10 to 30 minutes in the fifth and from 3.5 to 12 minutes in the sixth zone. The duration of the training interval in the fourth intensity zone can be 1.5-9 minutes. In the fifth intensity zone, shorter training intervals from 0.5 to 7 minutes are used. In the sixth zone, the shortest intervals from 0.3 to 3 minutes are used. The ratio of training load time to recovery time decreases as the intensity increases and the duration of the load decreases, on average from 3:1 to 0.5:1. These ratios are determined by the characteristics of sports. A significant share of the total workload of elite athletes is competitive activity, as these athletes can start 40-80 times a year.

Conclusions. The main feature of the training load of highly qualified athletes specializing in sports with a cyclical nature of athletic movements and lasting more than six minutes is that the total training load time in the first intensity zone is 75-80% of the total annual volume. On average, cyclical athletes perform from 12 to 14% of their workouts in a medium-intensity zone, and no more than 10% of their training loads are in a high-intensity zone. In most sports, athletes perform large amounts in low intensity zones using cross-training borrowed from other sports. Most high-intensity loads are performed during interval training or competition.

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