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# Technology of system-targeted management of pre-competitive training of highly qualified track cyclists

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## Abstract

*Purpose:* The purpose of this study is to develop and experimentally test the technology of system-targeted management of pre-competitive training of highly qualified track cyclists.

*Methods:* Analysis and generalization of literature data, analysis of competitive activity using time-keeping and heart rate monitoring methods, forecasting and modeling based on expert evaluation, instrumental research methods (Garmin and Watt Byte), model experiment simulating competitive activity in natural conditions, pedagogical experiment and methods of mathematical statistics.

*Results:* Based on the results of the study, it was established, in the 15 km Scratch race, it is recommended to run at an average speed over all distances of 53.8 at a heart rate of 178; in the "Tempo Race", an average speed over the entire distance of 52.9 at a heart rate of 179; in the "Elimination Race", an average speed over the entire distance of 52.6 at a heart rate of 182; in the "Points Race" at 25 km, an average speed over the entire distance of 54.4 at a heart rate of 178.

*Conclusion:* The article deals with the issues of system – targeted management technology, and also substantiates a comprehensive program of speed and power endurance aimed at effective management of the fitness of highly qualified track cyclists at the pre-competition stage of training.

**Keywords:** Track, cycling, technology, pre-competition stage, management, highly qualified cyclists.

## Introduction

Sport is a vital need, and the interests of society and the state are above all else. Sport is the essence, the political system, the state foundation, the ideological foundation. Here are the origins of winning prestigious international competitions, including cycling. The rapid growth of sports achievements in all track disciplines that has taken place in recent years, as well as the inclusion of the Olympic Games program, the Omnium race program on the track is a relatively new discipline.

It has been included in the Olympic Games program since 2012 in London. Until 2016, the program consisted of 6 disciplines: 1-lap from the move, 2-points race (30 km men, 20 km women), 3-elimination race, 4-individual pursuit, 5-scratch, 6-pit from a place (this program was held for two days). Since 2016, "Omnium" has included 4 disciplines: 1-scratch, 2-tempo race, 3-elimination race, 4-points race with subsequent holding within one day.

The analysis of the literature of recent years and the training process of cyclists, as well as participation in international competitions in the discipline “Omnium”, directed to the study of this problem, the search for solutions to problems related to the participation of athletes of the national team in competitions and the search for solutions to optimize and manage the training of track athletes in this discipline and, as a result, the growth of their skills (Potapov, 2014).

## Methods

In accordance with the target orientation of our work, we have put forward a number of tasks that we have set for ourselves and one of the main is to determine a rational system of the training process in the pre-competition training cycle, as well as to develop an optimal technology for managing competitive activity on the track, taking into account the regularities of pedaling dynamics depending on the variety of types of races and, of course, experimentally substantiate the components of the competitive activity system in the Omnium racing program on the track.

In accordance with the proposed goals, objectives and selected research methods, we came to the conclusion that we theoretically justified the effectiveness of using increased gear ratios in the Omnium racing program in the practice of training (with the growth of sports results). The technology of implementation of increased gear ratios and optimal values of the power and speed components of pedaling

are determined. The regularity of the dynamics of pedaling pace and stacking values depending on the speed of racing is established and practically justified. The practical expediency of the structure of the training process in the pre-competition training cycle is determined, and on its basis a program of strength orientation is developed, which ensures the gradual achievement of results by athletes in the types of races "Omnium" with the use of increased gear ratios. A group of typological features of track racers specializing in the Omnium racing program has been developed, and proper model characteristics of the components of pre-competition training have been created on their basis, orienting athletes to certain gear ratios and speed-power capabilities to show the best result depending on the variety of types of races. Developed and scientifically proven a complex of power-oriented training programs within the pre-competition mesocycle, which ensures the effective use of increased gear ratios in competitions, according to the types of Omnium races, due to the athletes' achievement of the highest level of power and speed potential by the time they participate in the main competitions of the season.

Our research has led to the determination and implementation of optimal values for the power and speed components of pedaling, and the prospects for using increased gear ratios in the Omnium racing program are revealed, (with the growth of sports results) developed and implemented the complex of strength-oriented training programs within the pre-competition macrocycle, based on increased gear ratios due to the athletes' achievement of the highest level of power and speed potential by the time of participation in the main competitions of the season, is analyzed on the basis of the system «Watt Bait». Based on the results of the study, models of competitive activity are constructed that take into account the optimal ratios of power and speed characteristics of pedaling for various levels of sports achievements in the Omnium racing program on the track. The ways of step-by-step implementation of the developed models based on the identified optimal structural variant of the annual training cycle construction are determined. And, as a result, a set of training programs of power and speed-power orientation were developed and tested in practice within the framework of interconnected mesocycles, which ensures the effective use of increased training load in competitions due to the increase in gear ratios due to the athletes' achievement of the highest level of power and speed potential by the time they participate in the main competitions of the season.

## Results and discussion

Developed by us technology competitive and training activities of cyclists in the "Omnium" program races on the track with further forecasting of the result in the main competitions of the season (Matkarimov, et al., 2011). The forecasting technique used in our work, based on expert evaluation, allows us to obtain specific quantitative parameters of competitive activity, on the basis of which model characteristics are developed (Table 1).

Predictive features models in races, the "Omnium" programs have on the track for the period of the main competitions set quantitative guidelines in the training of highly qualified pace racers and are the basis for controlling actions in the process of sports improvement(1). The optimal parameters of the model in the "Omnium" program races on the track reflect the result of each rider and all 4 types of the program(4). Thus, studies have shown the recommended gear ratios, on the basis of which the models have recommended in the race program "Omnium" is identified (Table 2).

When searching for optimal model parameters in Omnium races, the track reflects the results of each rider and all 4 types of the program. Thus, studies have shown on generalized models of competitive activity, show the presence of significant differences in the tactical schemes of tempo races with different features of physical qualities and basic functional schemes (Table 3).

This makes it necessary to identify groups of athletes who differ in typological features of their fitness and structure of competitive activity. As a result of our research with highly qualified track athletes specializing in Omnium races, where we analyzed the dynamics of the ratio of power and speed components of pedaling, both in the pre-competition and competitive periods, testing the developed training programs, we note that the impulse increase in intensive work from mesocycle to mesocycle in the annual training cycle mainly affects the effectiveness of using increased gear ratios and, accordingly, the growth of sports skills of riders.

**Table 1.** **Typological types of races of the Omnium program on the track**

| Stating experiment | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Typological types** | Types of Omnium race | | Indicators | | | | |
| | | | Transfer | Average speed on the first lap ($\bar{x} \pm m$) | Distance speed ($\bar{x} \pm m$) | Watt (W) | Heart rate (s/min, $\bar{x} \pm m$) |
| **Speed** | Scratch race, 15 km | Before experiment | 52*14 | 51,9 | 52,0 | 770-1115 | 178 |
| | Tempo race 10 km | | 52*14 | 51,3 | 51,5 | 720-830 | 179 |
| **Strength** | Elimination race | | 53*14 | 52,4 | 52,6 | 832-990 | 182 |
| | Points race 25 km | | 52*14 | 52,9 | 52,8 | 760-835 | 178 |
| **Speed** | Scratch, 15 km | After experiment | 52*14 | 52,7 | 52,8 | 775-1120 | 179 |
| | Tempo race 10 km | | 52*14 | 52,1 | 52,0 | 720-835 | 180 |
| **Strength** | Elimination race | | 53*14 | 52,4 | 52,8 | 832-990 | 187 |
| | Points race 25 km | | 52*14 | 52,9 | 52,9 | 760-850 | 178 |
| **Formative Experiment** | | | | | | | |
| **Typological types** | Types of Omnium race | | Indicators | | | | |
| | | | transfer | Average speed on the first lap ($\bar{x} \pm m$) | Distance speed ($\bar{x} \pm m$) | Watt (W) | Heart rate (s/min, $\bar{x} \pm m$) |
| **Speed** | Scratch race, 15 km | Before experiment | 58*15 | 52,1 | 52,2 | 780-1150 | 179 |
| | Tempo race 10 km | | 54*14 | 52,3 | 52,5 | 730-880 | 181 |
| **Strength** | Elimination race | | 56*14 | 53,7 | 53,8 | 910-1030 | 187 |
| | Points race 25 km | | 56*14 | 53,1 | 53,1 | 795-990 | 180 |
| **Speed** | Scratch race, 15 km | After experiment | 58*15 | 53,17 | 53,4 | 790-1130 | 179 |
| | Tempo race 10 km | | 54*14 | 52,7 | 53,2 | 760-890 | 184 |
| **Strength** | Elimination race | | 56*14 | 53,8 | 54,1 | 952-1100 | 188 |
| | Points race 25 km | | 56*14 | 53,4 | 53,7 | 849-890 | 181 |

**Table 2.** **Models of gear ratios in Omnium races on the track** (gears in inches and meters with a wheel diameter of 27 inches)

| **Rear gears** | | **Front gears** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| **13** | inch | 103,8 | 105,8 | 108,0 | 110,2 | 112,1 | 114,2 | 116,3 | 118,3 | 120,4 | 122,5 | 124,6 |
| | metre | 8,21 | 8,38 | 8,54 | 8,72 | 8,87 | 9,03 | 9,20 | 9,36 | 9,52 | 9,69 | 9,85 |
| **14** | inch | 96,4 | 98,3 | 100,2 | 102,3 | 104,2 | 106,1 | 108,0 | 109,9 | 111,8 | 113,7 | 115,7 |
| | metre | 7,63 | 7,78 | 7,93 | 8,09 | 8,24 | 8,39 | 8,54 | 8,69 | 8,84 | 8,99 | 9,15 |
| **15** | inch | 90,0 | 91,8 | 93,7 | 95,3 | 97,2 | 99,1 | 100,8 | 102,6 | 104,4 | 106,2 | 108 |
| | metre | 7,12 | 7,26 | 7,40 | 7,54 | 7,69 | 7,84 | 7,97 | 8,11 | 8,25 | 8,39 | 8,54 |
| **16** | inch | 84,4 | 86,0 | 87,7 | 89,4 | 91,1 | 92,9 | 94,5 | 96,1 | 97,8 | 99,5 | 101,2 |
| | metre | 6,67 | 6,81 | 6,94 | 7,07 | 7,21 | 7,35 | 7,48 | 7,60 | 7,74 | 7,87 | 8,00 |
| **17** | inch | 79,4 | 81,0 | 82,6 | 84,2 | 86,8 | 87,4 | 89,0 | 90,5 | 92,1 | 93,7 | 95,2 |
| | metre | 6,28 | 6,40 | 6,59 | 6,66 | 6,87 | 6,91 | 7,04 | 7,15 | 7,28 | 7,41 | 7,53 |

It should also be noted that with increased gear ratios and the impact on the sports result in fast-paced races of the Omnium program on the track, such power components as the development of speed and power abilities of racers, the ability to pass the starting acceleration at high gears, are becoming increasingly important in the training of athletes. What determines the

**Table 3. Models in the Omnium program races, the track reflects the result of each rider with different features of physical qualities and basic functional schemes (n=18)**

| Race type/indicators | Average speed per lap | Average speed over the entire distance | Heart rate | Pedal force/ Watt |
|---|---|---|---|---|
| **Scratch race, 15 km** | 52,9 | 53,8 | 178 | 770-1112 |
| **Tempo race, 10 km** | 52,3 | 52,9 | 179 | 720-830 |
| **Elimination race** | 57,4 | 52,6 | 182 | 832-990 |
| **Points race, 25 km** | 58,9 | 54,4 | 178 | 760-835 |
| **∑/Average indicator** | 53,5 | 53,4 | 179,2 | 770,5-941,7 |

primacy of speed and power endurance in the training of high-class cyclists in the races of the "Omnium" program, which includes a Tempo race, a 15 km Scratch, an elimination Race, and points Race at 25 km, the improvement of these components of the proposed method of constructing the training process contributed to an increase in the results of athletes.

## Conclusion

In conclusion in our research, it is noted that the use of highly qualified cyclists who specialize in racing the Omnium program on the track high gear ratios (7,088 – 7,350 m), in various pulse modes saves the athlete's strength at a distance and makes it possible to ride at a lower pulse, thereby being accompanied by the effect of economization in the activity of the cardiovascular system.

Also, in the course of the study, the dependence of the pedaling frequency on the speed of movement in the Omnium program races on the track was revealed, and the dynamics curve of the ratio of power and speed components and the pedaling endurance component was designed. Determined in the 15 km Scratch race (average speed on lap 52.9), (average speed on all distances 53.8) at heart rate 178; in the Tempo race (average speed on lap 52.3), (average speed on all distance 52.9) at heart rate 179; Elimination race (average speed on lap 57.4), (average speed on all distance 52.6) at heart rate 182; in the Race in points per 25 km (average speed 58.9), (average speed over the entire distance 54.4) with a heart rate of 178.

There is a highly effective growth of the components of athletes' power potential, while stabilizing the total volume of special training from mesocycle to mesocycle in the total volume of the annual cycle. Thus, the proposed method of a comprehensive training program, strength orientation in the annual training cycle includes a gradual increase in intense loads in the zone of mixed aerobic-anaerobic energy supply, which causes the achievement of maximum strength capabilities by the time athletes participate in the main starts of the year, in our case, at the Asian Cup.

When training highly qualified athletes, it is necessary to take into account the individual approach of training for each athlete and, depending on the specialization in the types of speed, power or endurance races of the Omnium program on the track, in accordance with this, the training process is determined in accordance with their typical characteristics, the ratio of gear ratios is determined. The effectiveness of the training process at the retracting stage of pre-competition training is determined by working on motor qualities (speed and strength endurance), so at the basic and transformative stages of the main aspects of integrated training of riders, depending on the individual abilities of the athlete, and pull-ups for all types of the Omnium program as a whole.

All-team parameters of pre-competitive training in the speed races of the "Omnium" program on the track are characterized by a certain variability, which is due to the use of the distribution of efforts on the track distance, the structure and content of the training process. Because of this, the training of speed racers should be managed on the basis of models, along with other model parameters of tempo races that are not included in the Omnium program, as well as standard models of competitive components that orient athletes to a certain distribution of effort at a distance. and turns of the track.

The study shows that racers with a predominant development of speed and strength qualities have the highest level of competitive

activity in scratch and tempo races, while athletes with a predominant development of strength and aerobic endurance have the highest performance in competitions in cases of performance in the elimination race and the points race.

Focus on our proposed training model using an individual approach in the form of Watts bytes and Garmint. Race Scratch minimum Wats 520, average 712 wat, maximum 1275 Wat, speed race minimum 490, average 690, maximum 1110 Wat, Elimination race minimum 708 Wat, average 850 Wat, maximum 1170 Wat, group race by points minimum 510, average 740, maximum 1240 Wat.

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