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**THE STRUCTURE OF THE FINAL PREPARATION PERIOD AND ITS EFFECTS
ON SPORT RESULTS OF SAILORS TAKING PART IN THE 2004
OLYMPIC GAMES**

Key words: Olympics, factors, periodisation, sailing.

ABSTRACT

The final preparation period before the main event used to be one of the most complex tasks. Its structural and organizational aspects undoubtedly help athletes determine and achieve peak performance. The main determinants and changes in the state of performance require to employ a great deal of information related to the competitors. Optimal loads, training methods, and exercises and drills used to be adapted and measured every day.

The objective of the present study was to find the crucial aspects influencing the final results, which should to be taken into consideration in the preparation period. The article aims to present the training structure and loads to optimize the final preparation period for high performance sailing before the Olympic Games competition, involving elite Finn dinghy and Mistral class sailors.

The study results point to the fact that sailors are clearly becoming more aware of training quality and its effects on their performance.

INTRODUCTION

Periodisation has been adopted by coaches of all sports as a professional way of monitoring and scheduling the effort spent in training so that it leads to the athletes' best performance in the long term. It involves dividing a year into a number of basic periods that are characterized by the sort of training done and the importance of upcoming competitions.

Most studies related to dinghy racing have concentrated on physiological demands of sailing [3, 5, 6, 13], others have studied the biomechanics of dinghy racing [7, 9] sailors' responses to training programmes and the psychological aspects of racing. However, very little has been written about the above affecting the final preparation period before the main competition.

One of the initial requirements of the final outcome in today's professional sport is the ability to generate peak performance on time. To reach this goal a scrupulously directed final preparation period is to be planned within the yearly training scheme, which would enable to obtain the master level in the main competition. This is a period lasting from a few days to a few weeks before the competition where the training load is progressively changed and possibly reduced [8, 11, 12, 14].

The structure of this period used to be extremely complex, involving multiple factors. The structure itself, the organization and the content of that period significantly influence the competitors' sport level. Successful management of this process requires proper feedback related to all training aspects influencing the competency level.

The overriding goal is to arrive at the main event in the best possible physical and mental shape. This requires regular training that tapers off just before the main event. The reason is to give the competitor time to recover and gather peak performance at proper time. Having in mind the current training level particular aspects characterizing the competitors shall be taken into consideration before the training sessions and competitions. As a result it helps to adapt particular proportions of exercises defined as basic, directed and special [4].

The objectives of the present study were to find the crucial aspects influencing the final results to be taken into consideration within the preparation period, to present training structure and training loads and to optimize the final preparation period in high performance sailing.

METHODS

The sailors taking part in the 2004 Olympic Games in Finn class and Mistral windsurfing were selected, taking into account different aspects of training and training loads.

The yearly plans of training and starting for Finn dinghy and Mistral windsurfers already qualified to the Olympic Games in 2004 were presented in their final form in November 2003. The following profiles were taken into consideration:

- a) training loads;
- b) nutrition requirements;
- c) physical fitness (physiological body efficiency tests);
- d) equipment factor (trim).

Final plans for Finn dinghy and Mistral windsurfers were eventually adopted at the end of May 2004.

The nutrition aspects were related to dehydration during racing, subjective quantification of liquids and food the sailors took on the boat and while training off-water as well as their optimal body weight. A proper diet was followed, according to weather conditions expected in Athens. Control tools were used to evaluate the body weight level in conjunction with physical fitness factors.

In the case of body efficiency tests laboratory methods were used for estimating the competitor's physical abilities. To evaluate the overall efficiency (oxygen) the tests with increasing intensity called "refusal tests" were applied, and to estimate the

non-oxygen efficiency Wingate Anaerobic – 30 sec. version test was used [1, 10, 13].

These methods have yielded some laboratory testing standards by which one can constantly control and verify the physical preparation. It allows a comparison of the results of all competitors in the same sport or various sports [2, 10].

To analyze training loads the sailors and coaches were required to complete training load sheets, testing their knowledge on physical loads themselves as well as proportions of particular training aspects. The sheet was administrated to the sailors selected to the Olympic Games and to their co-partners who helped the leaders in achieving peak performance on time. Data were compared between Finn dinghy and Mistral class sailors.

RESULTS

Training loads

The final preparation period consisted of 74 days for Finn and 71 days for Mistral, respectively. The supporting staff actively cooperated with sailors helping them to improve their theoretical knowledge and practical skills. The proportions of competition and training sessions were presented as follow:

- international events – 23 days (Finn), 26 days (Mistral),
- national events – 4 days (Finn), 8 days (Mistral),
- trainings abroad – 30 days (Finn), 15 days (Mistral),
- national trainings – 25 days (Finn), 33 days (Mistral).

Training loads took 312 hrs for Finn sailors and 365 hrs for Mistral sailors. The loads for both classes (Figure 1) are presented below:

- basic training exercises – 76 hrs for Finn (24.4%) and 85 hrs (23.3%) for Mistral, respectively;
- directed training exercises – 40.5 hrs for Finn (12.9%) and 50 hrs (13.7%) for Mistral, respectively;
- special training exercises – 195.5 hrs for Finn (62.7%) and 230 hrs (63%) for Mistral, respectively.

There were no significant differences in on and off-water conditions as reported by the sailors; however, different types of training exercises were adapted. Mean sessions per week, mean intensity

and mean total hours per week were increasing from the first to the seventh week and significantly decreasing within the last three weeks.

Nutrition

The comparison between Finn and Mistral class sailors concerned the amount of water taken during racing (two races per day) ranked from 1.1l for Finn to 1.4l for Mistral sailors. The proportion of subjects who reported experiencing dehydration ranked from 70% for Finn to 68% for Mistral. The proportion of food the sailors ate after a race were 60% of carbohydrate, 15% of fat and 25% of protein for Finn sailors; and 75% of carbohydrate, 11% of fat and 14% of protein for Mistral class sailors. Optimal body weights were achieved (Table 1).

Physical fitness

Comparison between oxygen efficiency tests. The comparison between oxygen efficiency tests (Table 2, 4) reported maximum oxygen consumption (VO₂max) of 4.16 l/min for Finn and 5.24 l/min for Mistral sailors and the anaerobic threshold (AT) of 68% and 83%, respectively. Every measured parameter yielded significantly better results for the Mistral class sailors.

Table 1. Nutrition aspects related to Finn dinghy and Mistral class sailors in the final preparation period before the 2004 Olympic Games

	Finn dinghy	Mistral class
Volume of water (l) taken during racing	1.1	1.4
Dehydration during racing (%)	70	68
Proportion of carbohydrate-rich food after racing (%)	60	75
Proportion of fat-rich food after racing (%)	15	11
Proportion of protein-rich food after racing (%)	25	14
Body weight (kg)	99	75

Comparison between non-oxygen efficiency tests. The comparison between non-oxygen efficiency (Table 3, 5) reported maximum power of 958 W for Finn and 905 W for Mistral sailors. The time to approach power max. was reported as 2.99 s and 3.33, respectively. The time to sustain power max. amounted to 2.84 s of Finn and 1.7 s of Mistral. The results made it possible to evaluate the phosphagen and glycolic efficiency in proportions of gaining power in the test. The results of Finn sailors were significantly better.

Table 2. Oxygen efficiency of Finn sailor

VO ₂ max [l/min]	VO ₂ max [ml/kg/min]	V _E max [l/min]	HR max [bpm]	Max power [W]	Max power [W/kg]	AT			
						[% VO ₂ max]	[mlO ₂ /kg/min]	HR [bpm]	[%HR max]
4.16	54.4	164	196	400	5.23	68	37.2	171	87

Table 3. Non-oxygen efficiency of Finn sailor

Power [W]	Max power [W]	Max power [W/kg]	Power drop index [%]	Time to attain max power [s]	Time to sustain max power [s]
958	950	12,43	22	2.99	2.84

Table 4. Oxygen efficiency of Mistral sailor

VO ₂ max [l/min]	VO ₂ max [ml/kg/min]	V _E max [l/min]	HR max [bpm]	Max power [W]	Max power [W/kg]	AT			
						[% VO ₂ max]	[mlO ₂ /kg/ min]	HR [bpm]	[%HR max]
5.24	65.2	176	176	495	6.16	83	54.1	162	92

Table 5. Non-oxygen efficiency of Mistral sailor

Power [W]	Power max [W]	Power max [W/kg]	Power drop index [%]	Time to attain max power [s]	Time to sustain max power [s]
905	898	11.17	24.5	3.33	1.97

Equipment factor

The comparison between Finn and Mistral sailors reported significant differences related to the equipment factor and its trim (Figure 2, 3). The Mistral class sailors were provided with very little training taking into account trimming aspects (10%), presenting physical fitness as the most

trained factor in the final preparation period. The Finn dinghy sailors presented equipment trim as the most valuable factor taken into account in the final preparation period (50%). Sailors reported that they believed their increased use of trimming tools had led to improvements in their racing performance.

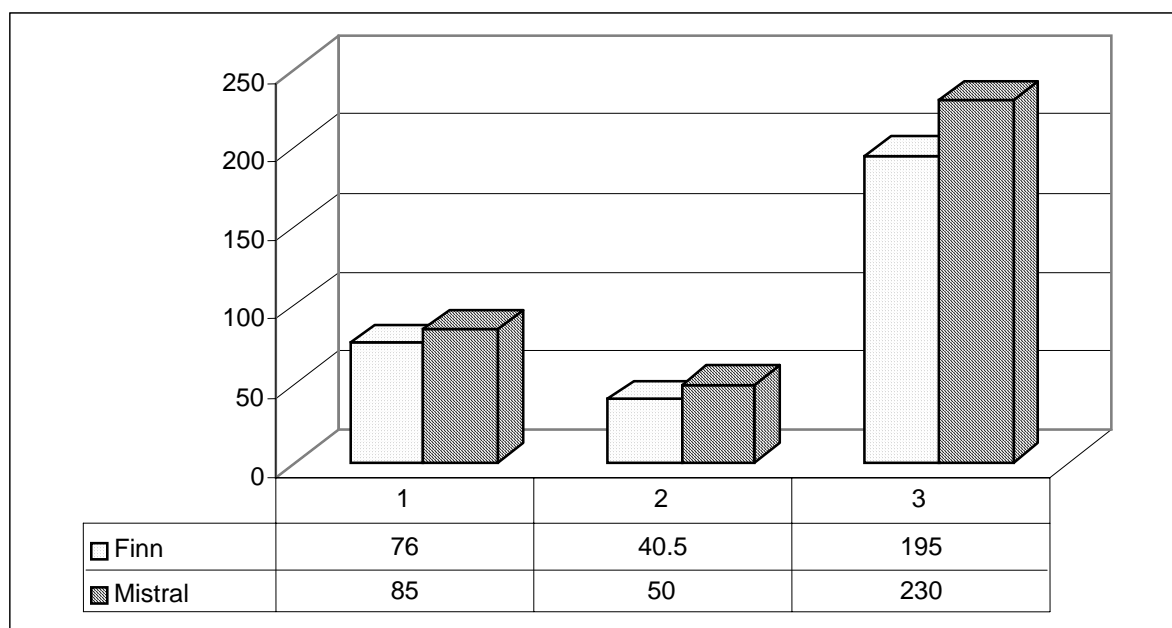


Figure 1. Training exercises in summary (hrs) related to Finn dinghy and Mistral class sailors in the final preparation period before the 2004 Olympic Games (1 – basic exercises, 2 – directed exercises, 3 – special exercises).

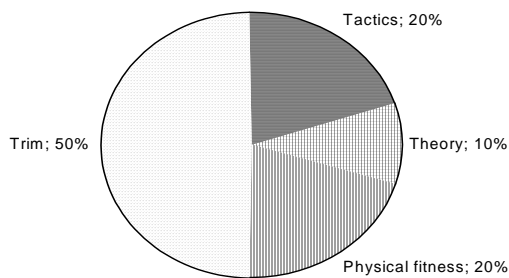


Figure 2. Training aspects in relation of equipment trim in the final preparation period of a Finn dinghy sailor taking part in the 2004 Olympic Games

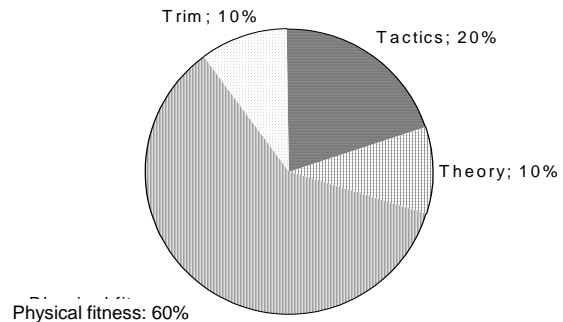


Figure 3. Training aspects in relation of equipment trim in the final preparation period of a Mistral dinghy sailor taking part in the 2004 Olympic Games

DISCUSSION

To the best of the author's knowledge this is a first study systematically examining the final preparation period of elite sailors taking part in the Olympic Games. The data obtained from the present study plays an important role in development of the knowledge of periodisation, especially taking into account the final period before the main competition. Improvements can be made to the quality and quantity of training support available to elite sailors in the future.

Top level Finn class coaches consider tactics and equipment as the most important factors influencing the final performance. Windsurfing coaches mostly respect physical fitness and tactics [15]. The research results and the opinions are also affected by their experience from Olympic preparations and events they managed in the past.

Training loads

No statistically significant differences were reported in the overall training loads between the two Olympic classes. The proportions of basic directed and special training exercises presented some differences related to particular tools and sessions as implemented by the coaches. The improvements were made after the 2003 World Championship and Pre-Olympic Test Events that provided both the sailors and the coaches with necessary information helping to plan and to manage the final preparation period in the most effective way.

Regular training is designated to provide ongoing loads that can be recovered from and

adapted to. However, many of the implemented specific exercises and workouts take several days to exert their positive effect. The goal of training is to achieve the fastest possible accumulation of positive loads and rests that can be safely handled.

Nutrition

Significant differences in nutrition indicate that Finn dinghy and Mistral class athletes require subjective and directly controlled nutrition preparation. The amount of fluids consumed during racing seems to be effective. Sailor's increased fluid intake seems consistent in relation of dehydration. Suffering the effect of dehydration during races would be a serious reason to increase the amount of fluid drunk subsequently.

The results suggest that sailors are becoming more and more aware of the harmful effects of dehydration and lack of food. They can easily develop sickness during sailing due to exposure to the sun and wind and insufficient layers of clothing.

Some special foodstuffs have been developed to match the specific nutritional needs of athlete – particularly for those before during and after training. A variety of carbohydrate foods shall be used in athletes' diets of athletes. Their various characteristics shall be matched with the immediate priority of the situation class requirements, overall balance and diet plan.

Daily monitoring require the choice of the appropriate "control tools", i.e. tests and indicators that could be used to evaluate the competitor's preparation level, as the basis for further planning or optimization of the training process. The results

during 10-day tests on the Olympic course acknowledged the importance of diet. Carbohydrate-based drinks and carbohydrate loading involving modified bumping-up carbo intake supported by diet supplements were factors taken into strong consideration.

Physical fitness

Between 50 and 70 percent of an average windy race is spent trying to hike the boat flat. In the case of windsurfing frequent pumping it is vital to keep the average speed. The discomfort inherent in these activities can be reduced by regular workouts specific to particular sailing classes. In aerobics or swimming it may be appropriate to maintain proper HR and blood circulation.

Windsurfing has become a sport for real athletes. When accelerating off the starting line top windsurfers pump the sail at a rate up to 120 pumps per minute. Obviously this intensity cannot be sustained and once in the clear air they slow down. However, the tactical challenge of sailing remains. Weakening of forearms is the most obvious area of fatigue. The forearm muscles are relatively small and, in result, blood is shunted, lactic acid builds up and the overall strength falls. These static contractions affect the athlete's endurance.

Most of the background training is high in volume but low in intensity because this encourages the fundamental development of all physical capacities. Although technical, tactical and psychological preparation is also vital in performance, good physical conditioning forms the basis for other performance factors developed during the planned period.

In the final preparation period this background shall be developed in particular fitness aspects. Endurance, strength and speed seem to be the most influential factors related to the Finn and Mistral class sailors. However, the appropriate proportion of these factors depends on the requirements of the particular classes. Mistral class sailors should pay special attention to endurance and strength; while Finn dinghy sailors should focus more on strength and speed. The obtained test results confirmed the correct course of training.

Equipment factor

The equipment factor affecting the final performance in sailing consists of the knowledge of basic equipment and ability to choose the hull, masts, sails and foils. The equipment factor is

directly connected to physical fitness, sailing conditions and technical abilities of trimming.

The equipment factor presented significant differences among Finn dinghy and Mistral class sailors. The fact that Finn sailors spent more time on trimming before the Olympics on and off-water suggests that Finn presented itself as more equipment value class than Mistral.

Obviously Finn class sailors seem to be aware of the requirements of their class. In the Mistral class sailors pay less attention to trim instead of equipment failures. It is thus necessary for all competitors to pay more attention to equipment quality. Equipment in every class should be checked in a detailed and careful way. Many failures are often hard to predict thus prevention should be also given significant consideration.

Conclusions

Elite Polish sailors have improved their nutrition and training habits. Taking into consideration the results reported by Finn dinghy (3rd place) and Mistral class (5th place) sailors in the 2004 Olympic Games the following conclusions can be drawn.

The quality and quantity of the final preparation period before main competitions depend on conceptualization of programme adapting fluctuating changes affecting the final performance, and on the supporting staff continuously cooperating with elite sailors at least two years before the start.

Equipment belongs to the most crucial factors affecting the Finn dinghy sailors. To achieve peak performance each training period requires athletes to be continuously monitored. Active coach-athlete cooperation and feedback should help in achieving peak performance.

Sailors are clearly becoming more aware of how the quality of training can improve their performance. The results proved that the final preparation period was productive and yielded significant results in the Olympic Games. However, there is still room for improvement.

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