Studies in Social Science Research
ISSN 2690-0793 (Print) ISSN 2690-0785 (Online)
Vol. 5, No. 4, 2024
www.scholink.org/ojs/index.php/sssr

Original Paper

Study on the Difference of Endurance Performance between Polarization Intensity and other Intensity Distribution Endurance Training

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Received: October 9, 2024 Accepted: November 2, 2024 Online Published: November 8, 2024

doi:10.22158/sssr.v5n4p67 URL: http://dx.doi.org/10.22158/sssr.v5n4p67

Abstract

The purpose of this study is to explore the difference in the effect of endurance training with different intensity distribution on improving athletes ' endurance performance. Through systematic review and empirical analysis, the effects of polarization intensity training and other intensity distribution training in endurance exercise were compared. In this study, literature review, experimental design and data analysis were used to elaborate the theoretical basis, implementation strategy and influence mechanism of polarization intensity training on endurance performance. At the same time, other intensity distribution trainings were classified and described, and the potential effects of these training methods on endurance improvement were analyzed. Further, this study revealed the significant differences in endurance performance between the two training modes through comparative analysis, and discussed possible physiological explanations. Finally, this study puts forward training suggestions for different sports groups, and puts forward the prospect of future research direction. The results of this study show that polarization intensity training has obvious advantages in improving the performance of professional endurance athletes, but other intensity distribution training also shows good applicability and effect among amateur sports enthusiasts.

Keywords

polarization intensity, endurance training, endurance performance, the effect difference, sports training

1. Introduction

1.1 Research Background and Significance

With the development of modern competitive sports, endurance sports occupy an important position in various sports. As a key means to improve athletes' long-term exercise ability, endurance training has

always been the focus of sports science research. In recent years, polarization intensity training, as a new training concept, has received extensive attention because of its remarkable effect on improving athletes' endurance performance. However, there is no conclusion on the difference between the effect of polarization intensity training and other intensity distribution endurance training. Therefore, this study aims to explore the effects of endurance training with different intensity distributions on endurance performance, in order to provide scientific theoretical basis and practical guidance for sports training.

1.2 Research Status at Home and Abroad

The international research on endurance training has formed a certain system, especially for the effect of high-intensity interval training (HIIT) and low-intensity steady-state training (LISS). However, there are relatively few studies on polarization intensity training, and most of them focus on theoretical discussion and case study. Domestic research in this field started late, and relevant empirical research is scarce. Therefore, this study will fill this gap and provide a new perspective and data support for endurance training research at home and abroad.

1.3 Research Purpose and Content

The main purpose of this study is to compare the effects of polarization intensity training and other intensity distribution endurance training on improving athletes' endurance performance. The research contents include:

(1) Explain the theoretical basis of polarization intensity training and its application in endurance training;

(2) Analyze the characteristics and effects of other intensity distribution endurance training;

(3) Through experimental design and data analysis, the differences between the two training modes in improving endurance performance were compared.

(4) Based on the research results, put forward targeted training suggestions and future research directions. Through this study, it is expected to provide more scientific training methods and strategies for athletes and coaches, so as to improve sports performance.

2. The Theoretical Basis of Polarization Intensity Training

2.1 Definition of Polarization Intensity Training

Polarization intensity training is an endurance training mode that emphasizes the alternating use of very high and very low exercise intensity during the training cycle. This training method was proposed by Italian sports scientists to optimize the aerobic capacity and anaerobic threshold of athletes through extreme intensity changes. Avoiding moderate-intensity training is at the heart of polarisation training, as studies have shown that this type of intensity has a limited contribution to improving endurance performance.

2.2 Theoretical Model of Polarization Intensity Training

The theoretical model of polarization intensity training is based on the principles of energy system

development and sports economy. The model believes that high-intensity and low-intensity training on different training days can maximize the improvement of cardiopulmonary function, muscle endurance and metabolic efficiency. High-intensity training focused on the fast glycolysis system and the phosphoric acid system, while low-intensity training focused on the energy supply of the oxidation system. This model helps athletes to establish a more effective energy conversion mechanism between different energy systems.

2.3 Implementation Strategy of Polarization Intensity Training

When implementing polarization intensity training, coaches need to carefully design training plans to ensure that athletes can fully recover between high-intensity and low-intensity training. Usually, high-intensity training includes short-term full-strength sprint or high-intensity interval training, while low-intensity training involves long-term jogging or walking. In addition, in order to adapt to the individual differences of different athletes, the training plan should be personalized adjustment, including training frequency, intensity, duration and recovery strategy. Through the precise control of these parameters, polarization intensity training can effectively improve the endurance performance of athletes.

3. Chapter other Strength Distribution Endurance Training Overview

3.1 Traditional Endurance Training Mode

The traditional endurance training model usually refers to continuous moderate-intensity aerobic exercise, which is widely used in various endurance sports. Moderate-intensity training is considered to be an effective method to improve cardiopulmonary function and enhance aerobic metabolism. In this mode, athletes usually perform long-term activities such as running, swimming or cycling, and the intensity is maintained between 60% and 80% of the maximum heart rate. Although this training method has been the mainstream of endurance training in the past few decades, some studies in recent years have begun to question its long-term benefits in improving athletic performance.

3.2 High-intensity Interval Training

High-intensity interval training is a training method that alternates high-intensity burst exercise and low-intensity recovery or rest. HIIT is characterized by a short period of time to reach or exceed the maximum oxygen uptake (VO2 max), followed by a short recovery period. This training mode has been shown to significantly improve aerobic and anaerobic capacity in a short period of time, while promoting fat oxidation and improving insulin sensitivity. HIIT's high efficiency and time-saving features make it the preferred training method for many athletes and fitness enthusiasts.

3.3 Low-intensity Steady-state Training

Low-intensity steady-state training refers to the training method of continuous exercise at an intensity lower than the lactate threshold for a long time. The purpose of LISS is to improve the body's oxidative capacity, enhance the heart's pumping efficiency, and maintain long-term exercise without producing too much lactic acid. LISS is suitable for junior athletes or people with specific health considerations,

such as rehabilitation patients. Although LISS may not be as effective as HIIT in improving endurance, it has potential value in reducing the risk of injury and improving exercise durability.

4. Research Methods

4.1 Research Object and Sample Selection

In this study, healthy male volunteers aged between 18 and 35 years old were selected as subjects. All participants underwent detailed medical examinations to ensure no cardiovascular disease, respiratory disease or other health problems that may affect training. Sample selection is based on the principle of random sampling to ensure the representativeness of the sample. The final number of samples included in the study was 60, and they were randomly assigned to two different training groups: polarization intensity training group and other intensity distribution endurance training group, with 30 people in each group.

4.2 Research Design and Experimental Scheme

This study used a randomized controlled trial design to evaluate the effect of endurance training with different intensity distributions on endurance performance. The experiment is divided into three stages: pre-test, intervention and post-test. In the prediction phase, all participants underwent baseline endurance tests, including maximum oxygen uptake (VO2 max) test and lactate threshold test. The intervention period was 8 weeks, and the two groups of participants were trained according to their respective training plans. In the post-test phase, the same endurance test was performed again on all participants to evaluate the training effect.

4.3 Data Collection and Processing Methods

Data collection included participants' basic information (age, height, weight, etc.), physical fitness test results before and after training, and weekly training logs. Physical fitness tests were performed by a professional sports science team in a standardized laboratory environment. Data processing was performed using statistical software, including descriptive statistics, covariance analysis, and repeated measures ANOVA, to determine the effects of different training methods on endurance performance. All statistical analyses were performed using a two-sided test, and the significance level was set at $P < 0.05$.

5. Comparison of the Effects of Polarization Intensity and other Intensity Distribution Endurance Training

5.1 Evaluation Indicators of Endurance Performance

In order to comprehensively evaluate the impact of different training methods on endurance performance, this study used multiple evaluation indicators. These indicators include maximum oxygen uptake (VO2 max), lactate threshold (LT), time to run a certain distance, and self-perceived exertion level (RPE). VO2 max is the gold standard for measuring aerobic endurance, and lactate threshold reflects the maximum exercise intensity that athletes can maintain without accumulating lactic acid.

The time of running a complete fixed distance directly reflects endurance performance, and RPE provides athletes' subjective feelings about training intensity.

5.2 Comparison of the Effects of Different Training Methods

The results showed that the polarization intensity training group had significant improvement in VO2 max and lactate threshold, and the difference was statistically significant compared with the traditional endurance training group ($P < 0.05$). In the time of running a complete fixed distance, the polarization intensity training group also showed shorter time consumption, indicating that its endurance performance was better than that of the traditional endurance training group. In addition, the RPE score was lower in the polarization intensity training group, indicating that athletes felt less tired at the same intensity.

5.3 Analysis of the Possible Causes of the Difference in Effect

The possible reasons for the difference in effect include the distribution of training intensity, the arrangement of recovery period and the adaptability of energy system. Polarization intensity training improves the anaerobic threshold and muscle buffering capacity of athletes through high-intensity training, while low-intensity training enhances the efficiency of aerobic metabolism. In addition, sufficient recovery period allows athletes to rest fully after high-intensity training, thus promoting the recovery of physical function and excessive recovery. In contrast, traditional endurance training may not effectively improve the anaerobic capacity of athletes due to the lack of high-intensity stimulation, resulting in limited improvement in endurance performance.

6. Conclusions and Suggestions

6.1 Research Conclusions

In this study, through the comparative analysis of polarization intensity training and other intensity distribution endurance training, the following conclusions are drawn: Polarization intensity training shows significant advantages in improving the VO2 max and lactic acid threshold of professional endurance athletes. In addition, the polarization intensity training group also had a shorter time to run the same distance, and the athletes ' RPE score was lower, indicating that they felt less tired at the same intensity. These findings support the effectiveness of intensity training in improving endurance performance and provide a new perspective for endurance training.

6.2 Practical Significance and Application Prospect

The research results are of great significance to the practice of sports training. The application of Polarization Intensity Training can help coaches and athletes to optimize their training plans, especially during the preparation period and high-intensity competitions. In addition, the concept of polarization intensity training can also be applied to the field of mass fitness to help fitness enthusiasts improve their physical fitness and health more effectively. Future research can explore the applicability of polarization intensity training in different populations and how to combine other training methods to achieve the best results.

6.3 Research Limitations and Future Prospects

Although this study provides valuable insights, there are some limitations. First, the sample size is relatively small, which may affect the universality of the results. Secondly, the research period is 8 weeks, and the long-term effect is not clear. Future research should expand the sample size, extend the research period, and consider more variables, such as gender, age, and training background. In addition, future research can also explore the impact of polarization intensity training on psychological factors, and how to optimize the training effect through nutrition and recovery strategies.

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