Coaching Applications

The effects of ten weeks block and reverse periodization training on swimming performance and body composition of moderately trained female swimmers.

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Abstract

The aim of the present study was to analyze the change in competitive times for the 100m (t100c) front crawl and body composition values, following 10 weeks of assessing twenty moderately trained female swimmers. The subjects were divided into two groups of training – Block periodization (BP) and reverse periodization (RP). The two groups performed identically in terms of volume and intensity but in different training protocols. The BP group began its training program performing aerobic training from weeks 1 to 4 and changed training to high-intensive interval training in weeks 5 to 8. The RP group began its program of high-intensive interval training from weeks 1 to 4 and changed to aerobic training from weeks 5 to 8. Both groups completed identical taper programs during weeks 9 and 10. Evaluations were made before the beginning of the program, at the 4th, 8th, and at the 10th week. Results show the RP group significantly reduced their t100c, after 10 weeks of training, and the BP group significantly reduced their body composition values. Accordingly, it is concluded that RP improves competition performance, and BP is a preferred option to improve body composition values in moderately trained female swimmers.

Introduction

Periodization of training is a process which includes variations of volume, intensity and frequency of training in order to improve athletes' sports performances. A goal of periodized programs is to optimize training in both short and long training periods (e.g., weeks, months, years). Most coaches and athletes, from beginners to elite-level performers, frequently employ periodized programs in an attempt to maximize performance, achieved through correct stress/recovery relationships.

A traditional program of periodization usually starts by building the aerobic training in a preparatory period and gradually altering the preparation by reducing volume and increasing intensity to a competitive period. In some sports training, different models of periodization have been suggested in which training loads are concentrated in short periods of time in an attempt to increase the number of peak performances per year by following the same progression – first an aerobic training period, followed by a period of intensity. Examples of this training include the Block Training System, and Block Periodization (BP). Because the three periods are designated Accumulation-Transformation-Realization; this program of periodization is referred to as ATR.

Reverse Periodization (RP) introduced a paradigm that is completely opposite to the tendency of the training load programmed by traditional periodization programs. Both programs (BP and RP) often conclude with a tapering period of reduction in volume prior to the main competition. The RP was studied in strength training, starting with high-intensity/low-volume and gradually increasing volume and reducing intensity. In fact, RP was first studied in weight-training but to date has been poorly studied in the context of swimming training

Because these processes of periodization are accompanied by changes in body composition, e.g. in a recent study where included 47 untrained women of 14-19 years old, the group swam two sessions per week during 14 weeks of 45 minutes of moderated low intensity training; at the end of the study the participants reduced significantly body fat mass in over 8% while increase significantly aerobic endurance capacity. In some cases anthropometric measures may be related to performance, but in in a previous study it was concluded that lean body mass appears to influence swimming performance, while body fatness is relatively unimportant.

However, no previous study has been conducted, comparing the effects of these two different trends of training, block and reverse periodization in moderately trained female swimmers.

Test of Performance

The test consists in swimming 100m crawl at a maximum effort. For each test, the swimmers were required to complete a 600m warm-up and rest for between 5 to 7 minutes before commencing the test. Swimming times were recorded by three

independent observers using three different chronometers The race was also video-recorded using a digital video-camera. Stroke rates were recorded from each swimmer using a stroke-register during the race. From this test was obtained data's of variables: time of 100m crawl (t100c), total strokes required to cover the distance of 100 m and stroke length.

Training and assessment protocols

The participants initiated the study after four weeks of summer period without training. Both groups performed identical volume and intensity of training but in different periodization models, BP began its training program performing aerobic period (Accumulation) including low intensity training and threshold training during the week 1 to 4 completing 12 km per week and changing to period of intensity (Transformation); training high-intensive interval training and threshold training in weeks 5 to 8 to completing 7 km per week in this second mesociclo. RP began its program from intensity period during the week 1 to 4 and changed training program to aerobic Period during the weeks 5 to 8. Both groups performed identical programs of training reduction, completing 5 k per week during the weeks 9 and 10 appointed realization in case of BP and taper in RP (Figure 1).

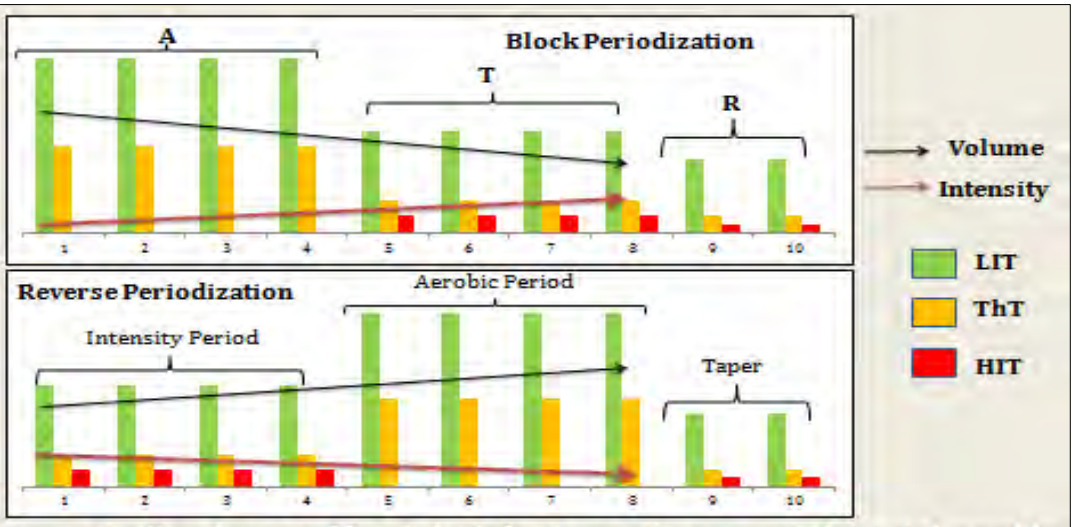

Figure 1.- Tendency of load distributions. Represents by total weekly volume in each period; A=accumulation; T=transformation; R=realization; LIT=low-intensity training; ThT= aerobic threshold training; HIT= high-intensive interval training.

Discussion.

The aim of this research was to compare how the organization of BP and RP, affect improvements in swimming performance in moderately trained female swimmers after 10 weeks of training. The results obtained show how different distributions of volume and intensity of training caused different effects in swimming performances (100m crawl) and in body composition. To our knowledge this is the first study to compare BP and RP in swimming training. Similar to previous studies in fitness and

strength training, the present study confirms the different effectiveness of these two models of periodization – RP to improve performance and BP to improve body composition values.

Performance in 100m crawl

The results in 100m crawl and stroke variables show that at the end of the study results for both groups were highly influenced by the first period of training.

The BP started their program with aerobic training. The most important improvements derived from aerobic training combined low intensity with threshold training appeared at weeks four to six after increasing training volume; these improvements are evident in the economy of movement (length per stroke) coinciding with aerobic threshold considered between 2~4mM/l, with limited recruitment of fast twitch muscles fibers, but frequently traditional training programs based in aerobic volume training, spending between 6 to 11 months per year show no significant improvements in time of competition.

The RP initiated the study from the High-intensive interval training, this kind of work-load is the recommended training for improving the two aerobic and anaerobic metabolic functions as well as muscle buffering capacity and lactate tolerance. Previous studies coinciding with this research demonstrated that high-intensive interval training can be trained at the beginning of a cycle preparation and the assimilation occurs in less time than the aerobic period of volume of training.

Total strokes and stroke length

The BP start program during this time improved stroke length, when the group performed intensity training and taper periods; stroke values were changed but not significantly increasing the total number of strokes. The low intensity training featuring slow strokes proved very useful to the economy of swimming for long distances, but some studies support the idea of this is one of the main weaknesses for competitive swimming distances of 200m and less (Costill et al. 1991; Arellano et al. 1994; Termin and Pendergast, 2000). We confirm in the present study this group improved stroke values during the intense period of training and taper period, but not significantly.

The RP group began its program by increasing the total of strokes, during this period and decreasing stroke length modifying significantly ($p<0.05$) both values – that means this group decreased its efficiency index in the second period of training, when the period increased in volume and after the Taper period, this group improved its swim-efficiency index with a non-significant improvement in the frequency of strokes. The effect showed an important but not significant difference between groups in stroke length.

Some studies explain how these improvements comes from adaptations of the nervous system during speed-strength training similar than high-intensive interval training, and where improvements occurring in both, transmission from the central nervous system and responses such as a reflex-type level of the spinal cord with an increase of an agonist muscle activation and antagonist muscle relaxation

Moreover, these high improvements of RP can be attributed to the lack of experience of the participants, coinciding with other studies that demonstrated how a similar type of reverse periodization training (reverse step load) is a better option to improve sport performance for relatively untrained athletes, when compared to traditional periodization.

Taper period

The taper performed in the two groups between the 3er and 4th tests, represent considerably less than 2~3% improvement obtained in different sports, including triathlons and running in endurance races (over 10 minutes) which involve high training volumes for long distance competitions . This is in contrast to this study in which training volumes were moderate, adapted for a sprint race around 1 minute for moderately trained female swimmers.

The results of the taper performed by RP group show how the reduction of volume is optimal option when the intensity is trained at same level than in the competition is required.

Body composition

After 10 weeks of swimming training, the BP group obtained better results in all parameters of body composition. In this group the greatest decrease in fat mass and body fat percentage may be due primarily to the high values compared to the baseline. Despite this distribution of work-load in which the first period was focused on aerobic training following the second one which was focused in intensity training, it seemed to be more effective in reducing fat mass in young swimmers than the distribution model proposed in the RP.

In swimming highest values in fat-free mass combined with high reduction of fat mass affect in negative form buoyancy in water and in consequence swimming performance, this excessive muscle mass may increase the surface in resistance to water, which in some cases this gains in fat-free mass and strength are not a compensation of the increased resistance of drag forces in water.

Some competitors, with high values of fat mass, have acceptable performance in competitions. Therefore we suggest conducting training for lean muscle mass gain instead of training for reducing fat mass values. According to these results, the BP model is more effective than RP to influence body composition parameters, i.e. increase fat-free mass and decrease in body fat mass.

Limitations of the study

One weakness of our study was the limited experience level of the participants and the short period of the study. However, we believe that this study provides an important basis for understanding the effects of these two training protocols, making it possible for future studies using more swimmers that compete at a higher competitive level.

Conclusion

From the results obtained in this research, we recommend reverse periodization for swimmers at moderately trained levels of competition, if the allowed training periods are short, around ten weeks. For the researchers, it is advisable to make further studies at different levels and distances in competition to confirm the