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AUTHOR

G. Gregory Haff is an assistant professor in the Division of Exercise Physiology at the Medical School at West Virginia University in Morgantown, WV. He is a member of the National Strength and Conditioning Association's Board of Directors. He is a Fellow of the National Strength and Conditioning Association. Dr. Haff received the National Strength and Conditioning Association's Young Investigator Award in 2001.

Block Periodization Optimizes Endurance Performance in World-Class Kayakers.

Much debate exists about the optimal method for planning training to induce optimal performance gains in athletic populations. While periodization is accepted as a core concept in this process, debate exists about which models of periodization are the most beneficial. Specifically, the idea that traditional periodization models are not as effective as others has been suggested by several authors. Since there appears to be limitations in the traditional model, a modern trend is toward block modeling. Traditional periodization requires the development of many fitness characteristics simultaneously, while block modeling utilizes concentrated loadings which are applied in a sequential manner. While block periodization is commonly discussed by coaches and sport scientists, very little scientific inquiry has directly investigated the effectiveness of this model in athletes. Recently, researchers from Spain examined the effects of a traditional and block model of periodization. Ten world-class paddlers were utilized in this cross-over design. Assessments were performed at four time points across each annual training plan. Results of the study demonstrated that both models of periodization result in significant increases in maximal aerobic capacity even though the traditional periodization model required 120 more training hours than the block model. Additionally, the block model resulted in increases in paddling speed at peak VO₂ peak, paddling power at peak VO₂ peak, stroke rate at VO₂peak. Overall, these findings suggest the ability of block periodization to optimize performance to a greater extent than more traditional periodization models in advanced athletes. Additionally, the block model was able to optimize performance with significantly less time being dedicated to endurance training as a result of a better ability to maintain training residuals. Therefore, with advanced athletes it has been suggested that block periodization is a more effective model of periodization and additional scientific inquiry is warranted to see if block periodization is a superior model for other sports.

Garcia-Pallares J, Garcia-Fernandez M, Sanchez-Medina L, et al. Performance changes in world-class kayakers following two different training periodization models. *Eur J Appl Physiol*. (in press)

Combining Resistance and Endurance Training Improves Tactical Operational Performance.

When looking at tactical operators, such as soldiers and police officers, there is a large requirement placed upon manual performance tasks such as lifting and carrying tasks. Recently, more women have begun to work in these areas and physical performance may occur in response to their specific strength levels. Because muscular strength has been suggested to impact tactical performance it may be warranted to include strength training in the preparation of tactical operators. Recent researchers from the US Army Research Institute, in conjunction with the University of Connecticut, examined the effects of resistance training, endurance training, and combined resistance training and endurance training on performance. Fifty-six women were randomly assigned one of four training interventions each of which lasted eight weeks: 1) endurance training, 2) resistance training, 3) combined training, and 4) control training. Each of the training interventions (endurance, resistance and combined training groups) exercised on three non-consecutive days. Specifically, the endurance group performed a combination of steady state aerobic exercise and high-intensity interval training. The resistance training group performed a daily undulating resistance training program in which Mondays required 3 x 12RM, Wednesday required 3 x 8 – 10RM, and Friday required 3 x 6 – 7RM. The combined group performed both training interventions on the same day of the week, while the control group performed no exercise training. Results indicated that the highest gains in strength were noted for the resistance training group while the endurance group produced the least gains in strength. Strength gains demonstrated the following pattern: strength training > combined > endurance > control. While the following pattern was noted for improvement in maximal aerobic capacity: combined > endurance > resistance > control. Additionally, the obstacle course and drag test demonstrated the following pattern of improvement: combined > resistance > endurance > control. Ultimately, it was determined based upon this data that tactical operators were best prepared for their jobs through the use of a combined resistance and endurance training program. While the data generated by this study is interesting, more studies are necessary in order to determine the optimal integration of training factors for tactical operators.

Hendrickson NR, Sharp MA, Alemany JA, et al. Combined resistance and endurance training improves physical capacity and performance on tactical occupational tasks. *Eur J Appl Physiol*.(in press)

High-Intensity Interval Training Improves Performance and Maximal Aerobic Power in Alpine Skiers.

Alpine skiing is a sport which requires high levels of technical skill, aerobic and anaerobic power and capacity, as well as leg strength. There are numerous methods that can be used to address these issues. Recently, the use of high-intensity intervals has been suggested as a method for stimulating significant performance improvements. Recently, researchers from Switzerland examined the effects of 15 high-intensity interval sessions performed in an 11-day period. Sessions consisted of four 4-minute high-intensity intervals performed on a cycle ergometer or a ski-specific obstacle course. Participants exercised to 90 – 95% of maximal heart rate separated by 3-minute recovery periods. Training sessions were blocked into three 3-day periods in which ergometer training was undertaken four times, while an obstacle course was performed once. The interval training intervention resulted in a significant 6% increase in maximal aerobic power, a 5.5% increase in relative peak power output, and 9.6% increase in power output at the ventilator threshold. The results of this study suggest that short term blocks of intensified interval training result in increased markers of endurance performance which may be useful if applied appropriately in a periodized training plan.

Breil FA, Weber SN, Koller S, et al. Block training periodization in alpine skiing: effects of 11-day HIT on $\text{VO}_{2\text{max}}$ and performance. *Eur J Appl Physiol*. (in press)

High-Intensity Interval Training Induces Improvements in Endurance Performance.

Recent evidence suggests that high-intensity interval training results in significant metabolic and performance adaptations that are similar to those seen in classic endurance training modalities. Many of the studies that support this contention have used all-out or maximal effort activities to induce these benefits. While this model appears to be efficient and effective, the intensities employed may not be well tolerated by most individuals. Therefore, recent research from McMaster University in Canada examined the effects of two weeks of interval training performed at the power output achieved at maximal aerobic power. A total of 8 – 12 60-second intervals each separated by 75 seconds of recovery were performed every other day for two weeks. A total of six training sessions were completed for a total time commitment of 2 – 2.5 hours or ~20 – 29 minutes per session during the 2-week training period. This training intervention resulted in a significant improvement in time to complete 50kj and 750kj of cycling performance. Additionally, biopsy data revealed significant increases in mitochondrial enzyme activities. Specifically, cytochrome c oxidase increased by 29% and citrate synthase increased by 16%. Additionally, there was an increase in muscle glycogen stores and GLUT 4 transport protein concentrations. There was also an increase in mitochondrial biogenesis regulators which suggests that improvement in mitochondrial function has occurred. As a whole, this study demonstrated remarkable improvements in endurance performance as well as changes to the mitochondrial capacity with a minimal amount of training time. Therefore, it appears that high-intensity intervals offer a reasonable method for inducing significant endurance performance gains. ■

Little JP, Safdar A, Wilkin GP, et al. A practical model of low-volume high-intensity interval training induces mitochondrial biogenesis in human skeletal muscle: potential mechanisms. *J Physiol*. 2010;588(Pt 6):1011 – 1022.