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about the **AUTHOR**

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High Intensity Intervals Improve Aerobic Power More Than Moderate Aerobic Training

Recently research from Norway explored the effects of different methods of training that were matched for total work and frequency on markers of aerobic endurance. Forty healthy subjects were assigned to one of four training interventions: 1) long slow distance (LSD) performed for 45 minutes at 70% of maximal heart rate, 2) lactate threshold running (LTR) performed at 85% of maximal heart rate for 24.25 minutes, 3) 15/15 interval training (15INT) in which 47 sets of 15 second intervals performed at 90 – 95% of maximum heart rate interspersed with 15 seconds of active recovery performed at 70% of maximum heart rate were performed (total time ~23 minutes), and 4) 4 x 4 interval running (4INT) in which four intervals of 4 minutes at 90 – 95% of max heart rate interspersed with 3 minutes active recovery at 70% maximum heart rate were performed (~28 min). All training was performed 3 days per week for 8 total weeks. Training adaptations such as changes in stroke volume, blood volume, maximal aerobic power (VO2max), and running economy were determined in response to the training period. The highest percent change in aerobic power and stroke volume was noted for the 4INT (VO2max = +7.2%) and the 15INT (VO2max = +5.5%) training groups. The least change in aerobic power was noted in the LSD group. No training induced differences in blood or hematological responses were noted between the 4 training groups. Additionally, no changes in running economy or lactate threshold were noted between training groups. All groups improved the velocity of running at the lactate threshold (+9.6%). Based upon these results it appears that interval training has a greater potential to improve aerobic power. While the 15INT group produced significant improvements the authors suggested that the implementation of the 4INT protocol which uses longer intervals is warranted when attempting to improve aerobic power. This recommendation was made based upon the higher increases noted with the 4INT intervention and the ease at which this protocol could be administered. Of particular importance is to note that the 4INT training duration was -17 minutes shorter than the LSD training sessions. Thus when clients or athletes are attempting to maximize training in shorter durations of time the use of high intensity intervals may be warranted.

Helgerud, J, K Hoydal, E Wang, T Karlsen, P Berg, M Bjerkaas, T Simonsen, C Helgesen, N Hjorth, R Bach, and J Hoff. Aerobic high-intensity intervals improve VO2max more than moderate training. *Med Sci Sports Exerc* 39:665 – 671. 2007.

Can Daily Heart Rate Variability be used to Guide Endurance Training?

The present study was designed to examine the usefulness of daily heart rate variability (HRV) in the individualization of endurance training prescriptions. Theoretically, HRV can be used to guide training. For example when HRV decreases the training stimulus can be decreased, or maintain training intensity when HRV increased or remained the same. Thirty health subjects were divided into three treatment groups: 1) a training group (TRA) performed a 6 minute warm-up and cool down at 65% of maximal heart rate and a 30 minute bout of running at 85% of max heart rate 6 days per week for 4 weeks, 2) the heart rate variability group (HRV) performed either a low training bout (65% of max heart rate), a high training bout (85% of max heart rate), or rested depending upon the daily changes in heart rate variability, and 3) a control group that performed no training. Heart rate variability was measured at changes in the high-frequency R-R interval (Polar S819i) and heart rate (Polar s625x) as measured each morning. The interesting aspect of this investigation was that the daily manipulation of training based upon HRV appeared to result in significant improvements in endurance performance. The HRV resulted in a significantly greater improvement in both maximal aerobic power (VO2peak) and maximal running velocity, while the TRA group only improved their maximal running velocity. However, no significant differences were noted between treatment groups. Based upon these data the authors concluded that HRV may be a useful tool for guiding training loads in endurance athletes.

Kiviniemi, AM, AJ Hautala, H Kinnunen, and MP Tulppo. Endurance training guided individually by daily heart rate variability measurements. *Eur J Appl Physio*l 101:743 – 751. 2007.

What is the Prevalence of the Female Athlete Triad in Female Triathletes?

The female athlete triad is a multifactorial condition which includes disordered eating, amenorrhea (cessation of menstruation), and osteoporosis. Recently, researchers from the Medical College of Wisconsin examined the prevalence of the female athlete triad in a club triathlon team. Fifteen women participated in this investigation. Disordered eating and menstrual cycle status were evaluated with the use of questionnaires, while occurrence of osteoporosis was evaluated with the use of dual-energy x-ray absorptiometry (DEXA). The results of the investigation revealed that 65% of the athletes were training under a significant calorie deficit. Fifty three percent of the athletes had a deficit in carbohydrate intake, 47% of the athletes had insufficient fat intake, and 40% of the athletes were deficient in protein intake. Additionally, it was determined that 33% of the athletes did not consume enough calcium in their diet. Forty five percent of the athletes demonstrated signs of amenorrhea. However, the athletes bone mineral density was normal at the lumbar spine and left hip. Based upon these results it appears that female club triathletes are at risk for some of the components of the female athlete triad. When the athletes were questioned about the female athlete triad over half of the athletes were unaware of what the female athlete triad is. The researchers concluded that it is important for female triathletes to be educated about the female athlete triad and appropriate interventions must be taken in order to reduce the prevalence of the disorder.

Hoch, AZ, JE Stavrakos, and JE Schimke. Prevalence of female athlete triad characteristics in a club triathlon team. *Arch Phys Med Rehabil* 88:681 – 682. 2007.

Upper Body Explosive Strength and Power are Related to Cross Country Skiing Sprint Performance

Recently researchers from Austria examined the relationship between upper body power, strength, and sprint performance over 50 and 1000-m. The first part of the project was to develop a sport specific strength and power based testing protocol. The second part of the study was designed to evaluate skiing performance and relate performance to the strength and power based tests developed by the researchers. Double poling was simulated with a rollerboard device (weighing 7.5kg) which allowed the athlete to kneel while poling. In this exercise the athlete pulls themselves towards the elevated end of the machine. The first test performed of the rollerboard was a 4 repetition maximum test which required the athletes to move as fast as possible. After a 3 minute recovery period the athlete performed a 40 repetition test at maximum speeds. Skiing performance was then determined with the use of treadmill and field tests using roller skiis. The first treadmill test was a double poling exercise performed at maximal speed. All subjects started at 4 m/s performed for 30s then speed was increased to 7 m/s. Speed was then increased by 0.3 m/s every 5 seconds until a maximal speed was achieved. The second test was 1000-m double poling test which required the subjects to complete 1000 m as quickly as possible. The final test was a 50-m poling testing where the subject was to complete 50-m as fast as they could. Results of this study suggested that 40 repetition test was highly reliable and explained 84% of the variance in 50-m double poling and 61% of the variance seen in the 1000-m double poling test. Specifically there was a significant relationship between maximal upper body power output during the 40 repetition test and 50 and 1000-m sprint performance thus suggesting that utilizing methods to improve upper body strength and power are warranted for cross country skiers. Based upon this data the authors concluded that explosive strength and maximal power are key components to successful sprinting in cross country skiing.

Stoggl, T, S Lindinger, and E Muller. Evaluation of an upper-body strength test for the cross-country skiing sprint. *Med Sci Sports Exerc* 39:1160 – 1169. 2007. ■