

INTERVAL TRAINING BURN MORE CALORIES IN LESS TIME

By Kathleen Vonk

The primary reason most Americans give for why they don't work out is lack of time. (Incidentally, many also report watching three hours of television each day.) So just how are you supposed to be able to juggle your job and family as well as fitness on top of it all? "Make it a priority" is always a good answer, but even those dedicated to working out and staying fit do not always have the time to fit exercise into a busy day. Fortunately, there is a time-efficient alternative, and you don't even have to leave home to do it.

Interval training is a type of workout in which training intensities vary between high (usually anaerobic) and low (aerobic). The overall results include a higher calorie burn during a shorter session, an improvement in performance (speed, power and endurance), an increase in aerobic power,¹ higher tolerance to lactic acid and a higher caloric burn during and after the session due to *excess post-exercise consumption*, or EPOC.² Such a workout will improve both aerobic and anaerobic systems depending on the intensity and duration of the designed interval and recovery periods.

EPOC

When you first start exercising, your body requires more oxygen than is immediately available. You may feel winded until your oxygen intake matches



Tac Team Fitness



Agility ball drill with sprints



Classic "T-drill" in team competition format



Team movement and buddy rescue drills at the NTOA's 2011 conference in Richmond, VA

that which is required by your exercising muscles. This period of about 10 minutes is called the oxygen deficit state because your body is trying to catch up to the oxygen and fuel requirements. If you continue to exercise beyond 10 minutes, you reach a point when your breathing feels like it matches your exertion level and you have reached your steady state of exercise.

After you stop exercising, you continue to breathe faster than at rest, as your body recovers and repays the oxygen/fuel debt it has run up. This phase is called excess post-exercise oxygen consumption, or EPOC. You are burning more calories than at rest during this recovery phase, and it can last for several hours. The greater the intensity and duration of the workout, the greater the oxygen deficit, thus the greater the EPOC needed to recover. In other words, you will burn more “recovery calories” after your workout.

ENERGY SYSTEMS OF THE BODY

Knowing which energy system is predominantly used during exercise is important in achieving specific goals.

For example, if Officer Gonzales wants to improve his speed, he should not run long distances slowly. The intensity of exercise and the type and length of the rest intervals have to be specific to the energy system he wants to improve or train.

For street cops, it is important to train all the metabolic systems not only for a lifetime of good health and satisfying leisure time with family, but more importantly, for survival on the street. That criminal with a grudge who prides himself on his tolerance to pain may be willing to die before going back to prison.

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The energy systems of the body are all in use during physical activity, but a person’s intensity and duration of exertion determines which one is predominantly used at any given time. The goal of all three systems is to produce and use the energy found in adenosine triphosphate, or ATP.

Each system, however, produces ATP at a different rate, and in different amounts. Because of these benefits and limitations, each system is used for different levels of exertion. The three systems are the phosphagen system, glycolysis (fast and slow) and the oxidative system.

PHOSPHAGEN SYSTEM

The anaerobic system used during the first 10 seconds of intense activity is the phosphagen system, which produces ATP very quickly but in small amounts — hence it is good for only those first seconds of a sprint or a fight. In order for an officer to train this system to improve his start-up acceleration or forceful strikes and take-downs, he would need to incorporate short bouts of highly intense exercise, with enough recovery to replenish

the ATP (3 to 5 minutes) and creatine phosphate (8 minutes).

Aerobic metabolism will assist in replenishing these phosphagen substrates more quickly, so an active aerobic recovery is preferred over passive (walk rather than stop after short sprints). Work-to-rest ratios are generally in the range of 1:12 to 1:20 when training the phosphagen system, and exertion levels are 90 percent to 100 percent of maximum power.³ Adequate recovery between work intervals is of utmost importance; without it, the next work interval will be performed while fatigued and results will wane.

An example of incorporating interval-style training for this energy system might include performing the clean-and-jerk exercise repeatedly for 10 seconds, then walking or stationary cycling at an easy pace for eight minutes, and repeating this cycle for a set amount of time.

Another example might include a cycle of boxing as hard as possible for 10 seconds, then jogging for two minutes. Start-up power can be trained with very short sprints (up to 10 seconds), then walking the rest of the track back to the starting line for the next short sprint. Plyometrics are also excellent exercises for training the phosphagen system.

GLYCOLYSIS

Glycolysis is the utilization of carbohydrates (glucose/glycogen) to produce ATP, which is produced in greater amounts than the phosphagen system, but not as quickly. Carbohydrates are stored in the muscles and liver as glycogen, and used as fuel during glycolysis. Carbohydrates are the only source of fuel that can be metabolized anaerobically, so consumption of adequate carbs is of utmost importance for those who serve in emergency service professions.

Fast glycolysis is considered anaerobic, and will become the predominant system used if the intensity of the



3D Dumbbell Matrix cross upper cut



Pull ups with elastic band

activity remains high during the first few minutes. To train and improve this system, work-to-rest ratios should stay around 1:3 to 1:5, and replenishment of fuel for this type of activity is obtained through the ingestion of carbohydrates post-workout. This means no low-carb/high-protein diets for officers who must be able to fight at high intensities at any given moment!

Training the fast glycolysis system through the use of intervals can be achieved with just about any type

of activity, whether indoors or out.

Treadmill intervals might consist of a five-minute warm-up, 10 inclined or speed intervals of 60 seconds each, followed by two minutes of level or slower running. The result will equate to more calories burned when compared to an equal amount of time spent at a steady pace, and both the oxidative and glycolysis systems will improve as well since intervals toggle between the two.

Outdoor hill repeats, fartleks and cycling sprint intervals are all examples of outdoor interval training. Rowing machines, elliptical and stair climbers are all great options for interval training and improving the glycolytic system, as long as the work intervals are increased to the point of higher intensities into anaerobic metabolism.

Results will enhance an officer's acid buffering mechanism so that the increases in lactic acid within the working muscles will take longer to accumulate, improving the officer's ability to tolerate the resulting burning feeling, making it possible to fight longer. Through training, achieving even a slight delay in the onset of lactic acid accumulation can buy an officer valuable seconds in a very intense altercation.

Slow glycolysis is sometimes (incorrectly) called "aerobic" glycolysis, even though neither form of glycolysis is dependent upon oxygen. Slow glycolysis is the breakdown of carbohydrates (glucose) to produce ATP to be used aerobically in the oxidative system, and without lactic acid being produced (as it is in fast glycolysis).

LACTATE THRESHOLD

During aerobic or slow glycolysis, lactate is produced but recycled continuously, and the acidity in the muscle remains stable. Activity that pushes the upper limits of aerobic metabolism and crosses over into anaerobic metabolism (fast glycolysis) can result in an increase in lactate above the baseline



Team movement training in full tactical gear

concentration, because the blood lactate cannot be recycled as quickly as it is produced, as is the case in a prolonged intense fight.

This point at which lactate begins to accumulate markedly is called the *lactate threshold*, or LT. Those who train at and near the LT can increase the time it takes to start this accumulation of blood lactate, and therefore delay the time at which they must slow down or move with less intensity.

An important goal for street cops is to train for their personal LT to occur later in the altercation than in untrained criminals. Even if this buys an officer only a few seconds, it could mean the difference needed to win that forcible arrest situation.

OXIDATIVE

The oxidative system has the greatest capacity for producing the most ATP — hundreds of them burning fat — but the process takes much longer than the phosphagen system or glycolysis. The oxidative system is the primary system used at rest and at lower intensities. It burns mostly fat and carbohydrates, and

proteins are used only during times of starvation or prolonged activity such as a marathon or triathlon (90 minutes of exertion or more).

The oxidative system is the primary method employed beyond the first three minutes of activity, and intensities are lower than in the anaerobic systems already described. The oxidative system can be trained with intervals as well, whether tapping into anaerobic intensities or staying just below. Greater



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improvements can be made and more calories and fat burned as the intensity levels rise near the point at which you transition from aerobic to anaerobic activity or LT.

Work-to-rest ratios are usually 1:1 or 1:2, depending on fitness levels when training the oxidative system. Higher intensities but staying within aerobic zones will even better train the oxidative system, improve cardiovascular health, and burn more calories (and fat) as well. Sitting on a stationary recumbent bicycle and pedaling at a nice easy pace while reading a magazine is still beneficial (just as getting up and changing the channel rather than using the remote), but you are not necessarily burning a lot of calories or improving aerobically.

Interval training for the oxidative system may include stationary cycling for one minute, then kicking it up a few notches but remaining aerobic for the next minute, and repeating this cycle for the duration of the workout.

Training the oxidative system can also be achieved with anaerobic intervals or higher aerobic intervals. Training at such intervals can last for up to five minutes or even longer, depending on fitness levels and desired goals. The most accurate way to ensure proper intensity levels is through the use of a heart rate monitor.

HEART RATE MONITORS

Using a heart rate monitor will make it easier to ensure proper goal achievement through the use of target heart rate zones. It is much easier (and more accurate) to glance at your wrist to see your intensity level than it is to stop and obtain your heart rate manually. To make it even easier, most monitors will give some type of audible signal or “beep” if you are below or above your desired target zone.

Maximum heart rate (MHR) is determined by the general formula

“220 minus age.” During interval training, target heart rates can fluctuate between 60 percent and 70 percent MHR during easy portions, and reach up to 85 percent to 90 percent of MHR during work intervals. Training the phosphagen system is best achieved when attaining 100 percent MHR levels with adequate recovery between each interval (up to eight minutes).⁴

CONCLUSION

Remember that proper nutrition both before and after exercise sessions can enhance results. After all that hard work you put into a session and program design, make sure to maintain those benefits through optimal caloric, protein, carbohydrate, fat, water, fiber, vitamin and mineral intake. Proper

training intensity and duration, proper rest and recovery, proper nutrition and adequate rest will all result in better performance on the street and more satisfying leisure time with loved ones while off-duty and throughout retirement. So, get out there and work your gluteus to its maximus, but then eat, rest and recover appropriately for maximal life satisfaction. ■

ABOUT THE AUTHOR

Officer Kathleen Vonk has been in law enforcement since 1988, currently serving with the Ann Arbor Police Department. She earned a BS in exercise science from Michigan State University and a BA in criminal justice. Officer Vonk serves as NTOA's Physical Fitness Section Chair. She also designed and teaches the Police Wellness Instructor course. She can be reached at kathyvonk@aol.com.

ENDNOTES

1. Haff, Gregory G. "High Intensity Intervals Improve Aerobic Power More than Moderate Aerobic Training." *NSCA's Performance Training Journal*, Volume 7, Issue 2, p. 10.
2. Baechle, Thomas R. and Earle, Roger W. "NSCA's Essentials of Strength Training and Conditioning." 2nd Ed., Human Kinetics, 2000.
3. *Ibid*, p. 88.
4. Polar's Protective Services Division is a heart rate monitor and training program specific to law enforcement, government and military personnel. The program is managed by exercise physiologist Tricia Sterland, who has extensive experience in applying all levels of heart rate data and training. She can be reached at tricia.sterland@polarusa.com.

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