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Radical Energy System Training

BY KIM GOSS

Innovative methods of losing body fat and developing sport-specific endurance

From 1987 to 1994 I was a strength coach for the US Air Force Academy, and one of my primary duties was to design weight training and conditioning programs for the football team. What I observed about Division I football is that many coaches play the game of follow the leader: Whatever the best football teams in the country are doing, *they* do too, because how can you argue with success? Unfortunately, after one season in which we lost more games than we should have, our coaches learned that one of the country's football powerhouses had added aerobic dance to their off-season conditioning.

Forget about all the other advantages that other team had going for it – such as many of the most talented athletes in the country – our coaching staff was convinced that aerobics was a key to their success and would also give the mighty Air Force Falcons an edge. It was a sad day when I stood on the sidelines and watched our proud young servicemen, led by a perky aerobics instructor, awkwardly mimic the cheer-leading squad in a series of cardio-funk kicks, hops and hip gyrations. The skill players handled the exercises just fine, but the linemen – well, let's just say linemen can't dance. To add to the embarrassment, most of the hockey

team made it a point to show up and amuse themselves by watching the spectacle. And if you've ever been around hockey players, you know they milked those moments for all the humor they could.

Eventually, the coaches recognized that despite the enthusiasm and professionalism of the instructor, aerobics didn't add anything positive to our program – that season was the only one we wasted doing aerobic dance. But why did this happen in the first place? If you ask me, I would say the coaches had fallen victim to the aerobics propaganda machine that insists that everyone, even football players, must do aerobics to perform their best.

Will aerobic training make an athlete stronger and able to jump higher? No; instead it can make them weaker

and decrease their jumping ability. Will aerobics improve endurance so that a basketball player will not be sucking wind in the fourth period? No; because basketball is not an aerobic sport. Will aerobics prevent injuries? No; but it can dramatically increase the risk of



Shown here at a seminar in La Jolla, California, are several coaches Paul has worked with (left to right): Kim Goss, Jerry Telle, [Paul Gagné], Paul Chek, Charles Poliquin and Yves Éthier.

Figure 1



Ninety percent of the energy used in a gymnastics competition comes from the short-term energy system.

developing overuse injuries. Despite these facts, many youth coaches believe that aerobic training should be an essential component of every conditioning program for athletes. And although working 15 minutes three times a week on an elliptical cycle with an aerobic training protocol should have no adverse affect on strength, speed or jumping ability, Paul Gagné offers a better alternative.

Think Energy System Training

“When coaches tell me they are doing cardiovascular training, I have to

explain to them that such terminology doesn’t exist,” says Gagné, a respected Canadian strength coach who has worked with many of the top exercise physiologists in the world on this subject. “The appropriate term would be *energy system training*; and rather than thinking in terms of aerobic or anaerobic, you need to look at the energy systems of the body as being divided into not two but three basic categories: *short-term*, *intermediate*, and *long-term* or *aerobic energy system*.”

Sports in which activities last less than 30 seconds, such as football, diving, 100m sprints and volleyball, use

Table 1: Energy System Contributions to Sport (by percentage)

Sport	Short-Term Energy System	Intermediate Energy System	Long-Term Energy System
Baseball	80	20	0
Basketball	85	15	0
Football	90	10	0
Golf	95	5	0
Gymnastics	90	10	0
Hockey			
Forwards/Defense	80	20	0
Goalie	95	5	0
Skiing			
Downhill	80	20	0
Cross-Country	0	5	95
Soccer			
Goalie, Wings, Strikers	80	20	0
Halfbacks	60	20	20
Swimming			
50m	98	2	0
200m	30	65	5
1500m	10	20	70
Tennis	70	20	10
Track			
100m	95	5	0
400m	80	15	5
1500m	20	55	25
Volleyball	90	10	0
Weightlifting	95	5	0
Wrestling	90	10	0

Adapted from *Interval Training for Sports and General Fitness* by Edward L. Fox and Donald K. Mathews (WB Saunders Co., 1974)

Figure 2



Elliptical cycles provide a low-impact form of energy system training.

**Figure 3:
Power Treadmill Exercises**

Moonwalk



Walking backwards with the heels up is a great exercise for knee rehab, as it emphasizes the vastus medialis, a teardrop-shaped muscle that crosses the kneecap.

Lunge Walk



Lunges on a treadmill are a great exercise for the hamstrings.

Crossover



Another great exercise for the adductor and abductor muscles of the legs.

High Knee March



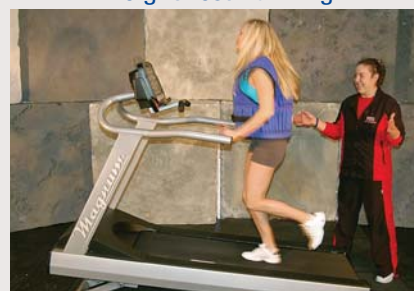
This exercise provides a great range of motion for the hip flexors.

Sideways Shuffle



The Sideways Shuffle works the adductor and abductor muscles of the legs. It's a super exercise for helping to prevent groin injuries.

Weight Vest Running



Performing treadmill exercises with a weight vest is a simple way to increase the intensity of a treadmill workout.

primarily the short-term energy system. Events lasting about 90-120 seconds use the intermediate energy system. Running 800 meters or swimming 200 meters is 65 percent intermediate. Swimming more than 1500 meters or running over 5000 meters would use primarily the long-term system. Table 1 shows several sports categorized according to their energy system.

"It's also important to understand that these energy systems fall on a continuum, gradually progressing from the short-term system to the intermediate

and the long-term," says Gagné. "Your body doesn't just flip a switch after two minutes of running and immediately become completely dependent upon the long-term system. Everything is interrelated."

The Case Against Aerobics

In the early '80s I was an editor at Runner's World Publications, which meant that many of my colleagues were runners who naturally thought that distance running events were the greatest sports in the world. In fact,

at one of our company meetings, our keynote speaker, who was one of our top consultants, exclaimed, “There’s nothing quite as exciting as watching a good marathon!” Ah, OK. And while it’s understandable that a runner would think that distance running is the greatest thing since PowerBars®, Gagné says that doesn’t necessarily mean that long-term training is the best form of endurance training for a football player, a tennis player or a gymnast (Figure 1).

“Perhaps the idea is so prevalent because so many exercise physiologists in the United States are distance running enthusiasts, but the fact is that there are many less-than-ideal consequences of focusing on aerobic training protocols,” says Gagné. In this regard, Gagné offers these interesting facts about aerobic training:

AEROBICS MAKES YOU SLOW. “Working the long-term energy system excessively decreases power by making the fast-twitch fibers behave like slow-twitch fibers,” says Gagné. “If a sprinter started adding three 45-minute aerobic sessions a week to their training, they would quickly notice an increase in their sprint times.” In fact, says Gagné, the effects of aerobic training are not localized. “If you train the upper body aerobically, not only will the upper body muscles get slower but so will your lower body muscles. If you were to row or swim for long distances, for example, your vertical jump would decrease.”

AEROBIC TRAINING CAN MAKE YOU FATTER. “Aerobic training places excessive stress on the adrenal glands and negatively affects the testosterone/cortisol hormone ratio, factors which reduce the ability to gain muscle and increase the likelihood of gaining fat,” says Gagné. “In fact, there are studies that show that the female aerobic instructors in the studies who taught an average of three hours a day averaged about 24 percent

bodyfat. My colleague Charles Poliquin calls this phenomenon ‘The Chunky Aerobic Instructor Syndrome.’”

AEROBIC TRAINING REDUCES ANTIOXIDANT LEVELS. “Aerobic exercise releases free radicals in the body, biochemicals that can increase the risk of illness in the body,” says Gagné. “Antioxidants from our foods can neutralize these free radicals, but with aerobic exercise the body produces such high levels of free radicals that it is difficult for the body to neutralize them sufficiently without supplementation.”

If aerobic training does play a larger role in your sport, Gagné warns that increases in VO2 capacity, a standard measure of aerobic fitness, plateaus in about six to eight weeks.

“Poliquin found that in working with the Canadian Alpine Ski team prior to the 1992 Olympics, increases in VO2 capacity plateaued within about six to eight weeks, and that it would take several months before the body was ready to increase its VO2 capacity again.”

Gagné cites a study that supports this finding: “Reduced Training Duration Effects on Aerobic Power, Endurance, and Cardiac growth,” by R. C. Hickson et al. (*Journal of Applied Physiology*, 1982, 53:225-229).

The practical application of this information is that an athlete could stress the long-term energy system for six weeks, such as by exercising on an elliptical cycle (Figure 2) for 45 minutes three times a week, at 75 percent of

Table 2: Power Treadmill Workout, Beginner/Intermediate Level

	Time	Speed	Incline
Warm-up			
Walking	5m	slow	flat
Circuit #1:			
Moonwalk	2m	slow	flat
Walking	1-2m	slow	flat
High Knee March	2m	slow	flat
Walking	1-2m	slow	flat
Sideways Shuffle	2m	slow	flat
Walking	1-2m	slow	flat
Lunge Walk	2m	slow	flat
Walking	1-2m	slow	flat
Crossover	2m	slow	flat
Walking	1-2m	slow	flat
Circuit #2:			
Moonwalk	2m	slow	high
Walking	1-2m	slow	flat
High Knee March	2m	med	high
Walking	1-2m	slow	flat
Sideways Shuffle	2m	med	med
Walking	1-2m	slow	flat
Lunge Walk	2m	slow	high
Walking	1-2m	slow	flat
Crossover	2m	med	med
Cooldown			
Walking	5m	slow	flat

Notes:

m = minutes

Speed Settings: slow, medium (med), fast

Incline Settings: flat, low, medium (med), high

“Use only a sturdy treadmill. A treadmill purchased via an infomercial or at a discount sporting goods store may not hold up to these demanding exercises.”

Paul Gagné

maximum heart rate. Then the athlete could reduce their workouts to just one session a week for three months before performing another aerobic cycle. Gagné says the effectiveness of this program is evidenced by the fact that when Poliquin used this program with his skiers, they showed higher VO₂ maxes than the cross-country team!

The Radical Energy System Protocols

If the short-term energy system and the intermediate energy system are both involved in the athlete's sport, Gagné recommends using an interval-training approach. Interval training involves alternating bouts of high-intensity exercise with low-intensity exercise. For example, if you were to sprint the straightaways on a track and walk the curves, this would be a form of interval training.

One advantage of interval training, besides working the appropriate energy system, is that it is a superior method of fat loss. “Peer-reviewed research has shown that interval-type training produces a greater loss of subcutaneous fat than conventional training,” says Gagné. In fact, Gagné was one of the test subjects in a study published in the July 1994 issue of *Metabolism*, “Impact of Exercise Intensity on Body Fatness and Skeletal Muscle Metabolism.” The authors concluded, “The results of the present study show that for a given level of energy expenditure, a high-intensity training program includes a greater loss of subcutaneous fat compared with a training program of moderate intensity.”

To make the interval training even more effective, Gagné has developed many protocols using medicine balls, power sleds and even sledgehammers! He also developed a “Power Treadmill Workout” that includes many interesting ways of exercising on a treadmill. (Table 2). “Since sports include lateral components, it would be more sport specific when using a treadmill to include a variety of exercises, such as shuffling sideways or even backwards,” says Gagné. “In sports such as lacrosse and soccer, performing energy system training that includes lateral movements would be more sport specific, as the muscles would be worked in the manner more commonly used in those sports.”

Using the exercises shown in Figure 3, Table 2 shows a power treadmill workout for athletes who primarily need to condition the short-term and intermediate energy systems. It consists of two circuits of exercises, with the second circuit being much more difficult than the first.

Before performing these types of power treadmill workouts, Gagné offers several precautions. “First, use only a sturdy treadmill,” says Gagné. “A treadmill purchased via an infomercial or at a discount sporting goods store may not hold up to these demanding exercises. Also, you should have a spotter and use the safety rails, especially when first performing these exercises or performing them at high speeds; make certain you allow at least six feet of open space behind the treadmill.”

BFS's sports liability consultant Dr. Marc Rabinoff agrees with Gagné.

“People fall off treadmills all the time, even when treadmills are used in the conventional manner – that is not the problem. The problem occurs when there is insufficient space between the end of the treadmill and a wall or another object. I've been an expert witness in three cases involving treadmills where the individuals fell off the machine and died because they hit walls that were too close to where the end of the machine had been positioned.”

It's not that aerobics is a bad form of exercise, but it's not ideal for many athletes because such training can compromise strength, speed and jumping ability. Further, with the exception of a few sports such as distance running and swimming, aerobics will not increase sport-specific athletic endurance. If you are a teacher in a physical education class and have students who want to perform aerobics for its health benefits and they like to perform aerobics, fine. But if you want your athletes to be strong from start to finish, then you need to focus on providing the best energy system training programs for your athletes. BFS



Our models for this article are two gymnasts who train at the Olympus School of Gymnastics in Sandy, Utah. At left is Emily Kirk, a Level 7 gymnast; and Maegan Snodgrass, a Level 10 gymnast who will be attending Utah State on a gymnastics scholarship this fall.

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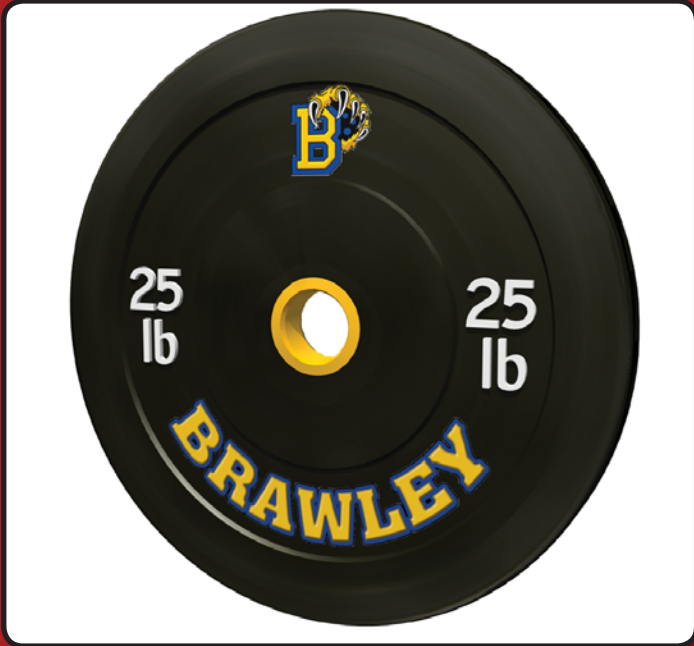
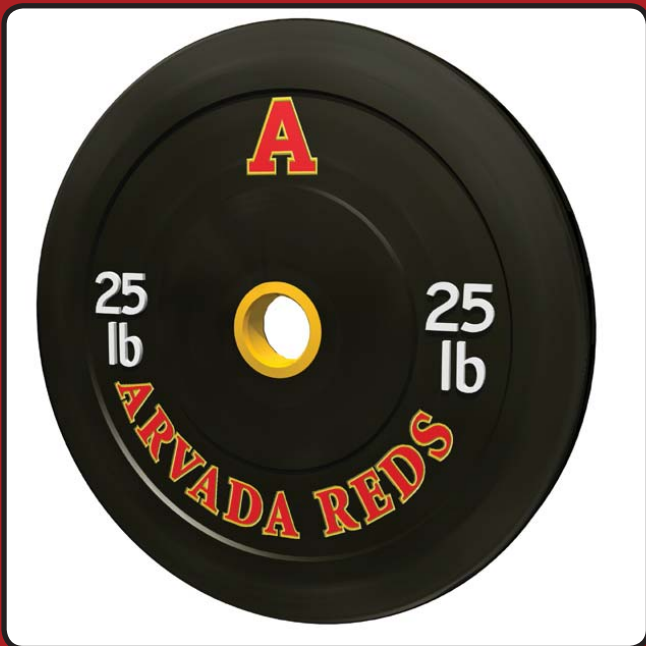
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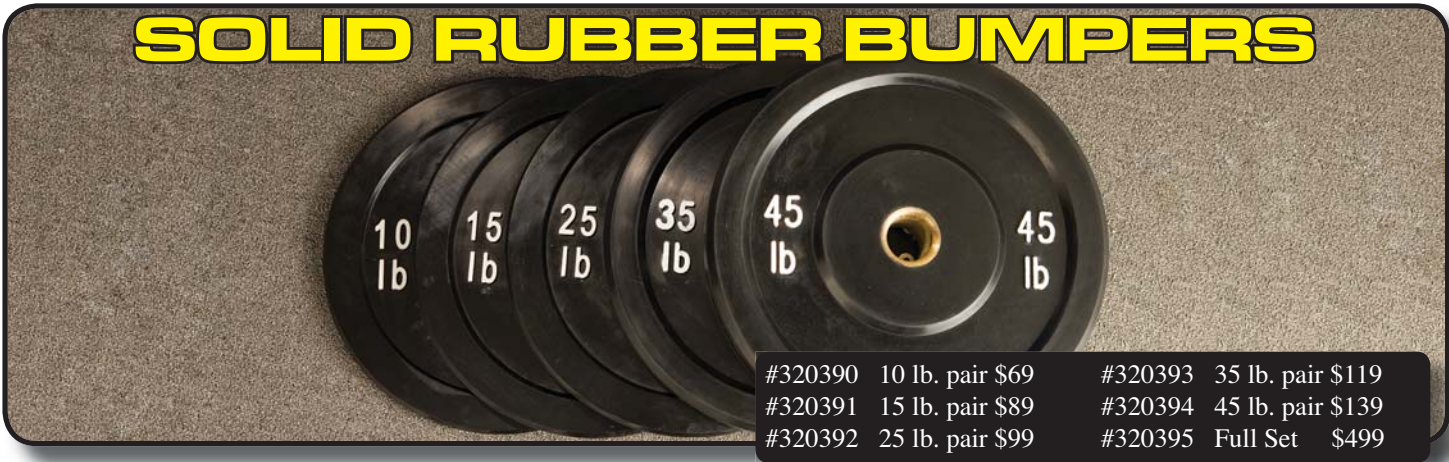
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