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Power Athletes and Distance Training

Physiological and Biomechanical Rationale for Change

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Abstract

The development of power lies at the foundation of all movement, especially athletic performance. Unfortunately, training programmes of athletes often seek to improve cardiovascular endurance through activities such as distance training that are detrimental for the performance of power athletes, rather than using other means of exercise. Performance decrements from continuous aerobic training can be a result of inappropriate neuromuscular adaptations, a catabolic hormonal profile, an increased risk for overtraining and an ineffective motor learning environment. However, long, sustained exercise continues to be employed at all levels of competition to obtain benefits that could be achieved more effectively through other forms of conditioning. While some advantageous effects of endurance training may occur, there are unequivocal drawbacks to distance training in the power athlete. There are many other types of conditioning that are more relevant to all anaerobic sports and will also avoid the negative consequences associated with distance training.

Power is directly proportional to distance and force, but indirectly proportional to time. Its development is paramount, regardless of the specific sport and percentage of each energy system involved, because many critical movements are executed as forcefully and quickly as possible. Table I outlines some common sporting movements and their respective power outputs, most notably their relation to time. Even intermittent sports of long continuous duration, such as basketball, soccer and rugby, involve repeated explosions; however, these exertions are only a fraction of the total game time.[1-3] Although these explosive movements are a major component of sports, a significant part of many athletes' conditioning has long consisted of distance running, an event that clearly does not simulate or directly prepare an individual for powerful actions such as sprinting or jumping. This brief article presents some of these current, paradoxical conditioning practices and provides an overview of the scientific evidence against long, slow distance training for power athletes. Possible explanations for the inclusion of sustained endurance exercise are also discussed, as well as some practical alternatives for performance enhancement.

Power athletes' sports can generally be grouped into two metabolic categories: (i) an anaerobic alactic system; or (ii) an anaerobic lactate system.[14] Anaerobic alactic sports, such as football and baseball, involve brief intermittent tasks involving very large power outputs. The predominant energy source for these sports is the phosphocreatine (PCr) system. Anaerobic lactate sports, such as basketball and soccer, involve repetitive high-intensity activity. Both the PCr/adenosine triphosphate (ATP) and glycogen/glucose systems predominantly provide energy for these sports. Interestingly, aerobic metabolic pathways are important as they are required for recovery during and after activity, mostly to provide energy for the resynthesis of PCr and the oxidation of lactate.[15] This role of oxygen in explosive movements, however, has lead to the assumption that an aerobic or metabolic base is required for sport, and that the optimal method of developing this base is through slow, long-duration exercise.

1. Current Practices of Distance Training

Sustained aerobic running, or long, slow distance training, often constitutes the first regimented physical preparation for young athletes, mainly as a means of general conditioning that is both simpler to prescribe and easier to perform. The first formally structured conditioning programmes generally begin in grade school, with examples that often include running 30–40 minutes at a light intensity to elicit a

Table I. Estimated average power output from kinematics of various sporting movements

Movement	Estimated average power (W)	Time (sec)	References
Bench press of 200kg by 75kg lifter	343	2	4
Ben Johnson 100m record from 0 to 20m	684.44	2.87	5
Golf swing from maximal backswing to ball contact	728.37	0.264	6
Speed-skating push off from standing still start	865.5	0.2	7
Throw 137 km/h (85 miles/h) fastball from maximal external rotation	2021.6	0.05	8
Standing vertical jump	2463	0.74	9
Baseball swing from maximal backswing to contact	2883	0.15	8,10
Pole vault	3662.64	1.48	11
Shot put delivery phase	3669.31	0.236	12
Jerk drive of 217.5kg by 97.7kg lifter	4170	0.22	13
Snatch 2nd pull of 172.5kg by 138.5kg lifter	5442	0.18	13
Clean 2nd pull of 240kg by 138.5kg lifter	6120	0.14	13

cardiorespiratory training stimulus and achieve a ‘metabolic base’.[16-18]

Although the science of strength and conditioning is no longer in its infancy and considerable evidence exists showing interference of strength and power gains in athletes who concurrently train aerobically,[19-21] coaches are often inclined to accept the same modes of training they used as players years ago. One example is the long-standing tradition of sustained exercise on a stationary bicycle in the sport of ice hockey. Although this implement is predominantly used for more relevant forms of conditioning, such as interval training, a recent study surveyed 23 national hockey league strength and conditioning coaches, to find that ten of these coaches currently use prolonged, continuous exercise testing on stationary bicycles to determine maximal oxygen consumption ($\dot{V}O_{2max}$).[22] While such oxygen consumption ($\dot{V}O_2$) tests usually last <15 minutes, a review by Montgomery[23] revealed that the average hockey shift lasts 30–80 seconds with 4–5 minutes of recovery between bouts, suggesting the use of more sports-specific evaluations. Though this survey revealed the majority of coaches used more relevant practices, such as testing of more anaerobic indices and periodisation of their athletes' training programmes, there is no place for the inclusion of sustained aerobic testing in a lactic, cyclic sport such as hockey.

These conditioning practices are not limited to professional hockey as a survey of major league baseball found that five strength and conditioning coaches reported measuring cardiovascular endurance,[24] despite the sport of baseball being primarily an anaerobic sport and that a high aerobic capacity is not important.[25] Methods used by these coaches included the 1-mile (1.6km) run, 1.5-mile (2.4km) run and 2-mile (3.2km) run.

A recent survey of strength and conditioning coaches in the National Basketball Association (NBA) revealed that two coaches used $\dot{V}O_{2max}$ tests and three others used prolonged treadmill tests, resulting in more NBA coaches testing aerobic energy systems than anaerobic energy systems.[26] These practices occur despite basketball predominantly using the anaerobic energy system.[27] This is similar to National Football League strength and conditioning coaches who continue to use tests of endurance, such as the 12-minute run or 1-mile run.[28] This aerobic focus persists despite the available research indicating that these sports predominantly use anaerobic energy pathways, and that the activities of sprinting and jumping require large mechanical power outputs.

By participating in sustained aerobic conditioning, athletes in power sports are engaging in training that may be detrimental to their overall performance. While aerobic energy production is required to some extent, the use of slow, long-duration exercise may negatively impact strength and power adaptations.

2. Performance Decrements from Distance Training

Previous studies on trained individuals have shown that power development is impaired when training incorporates a moderate to high degree of sustained aerobic exercise.[20,21,29] Performance in these studies was generally measured as strength, speed or power, utilising tests such as one repetition maximum (1RM), 20m sprint and vertical jump. The previously mentioned studies, as well as others, will be discussed in detail and demonstrate that performance decrements may be a result of neuromuscular and endocrine adaptations favourable for reducing energy cost, specific to endurance training, as opposed to maximising mechanical power. An additional hypothesis is that the volume of endurance training interferes with adaptations to strength and power training.[21]

2.1 Neuromuscular Considerations

Slow, continuous exercise specifically compromises the ability to produce force at the high-velocity, low-frequency region of the force-velocity curve, the zone of power production.[30] Hakkinen et al.[31] examined the effects of concurrent strength and endurance training (SE) versus strength training only (S) on the 1RM strength of leg extensors, maximal isometric force, cross-sectional area and rate of force development in men. Both the S and SE group had the same resistance exercise regimen of only 2 days/week, and the SE programme included an additional 2 days/week of continuous training on an ergometer, ranging from 30 to 60 minutes in a single session. The study lasted 21 weeks in an attempt to dilute the overall training volume and reduce strength and endurance training incompatibility due to overtraining. After the 21-week training period, similar increases ($p < 0.05$–0.001) occurred in S and SE for the 1RM, maximal isometric force, and cross-sectional area of the quadriceps femoris. However, S showed an increase in the rate of force development ($p < 0.01$), while no change occurred in SE. The average integrated electromyogram of the vastus lateralis during the first 500ms of the rapid isometric action increased ($p < 0.05$–0.001) only in S. Therefore, when compared with S, the SE group did not achieve the same gains in rapid force production and associated increases in rapid neural activation. This study emphasises the importance of every component of an athlete's training programme because even low-frequency continuous distance training can lead to interference in explosive strength development.

This ability to produce force rapidly is influenced by the rate at which adenosine triphosphatase (ATPase) splits ATP into adenosine diphosphate (ADP) and inorganic phosphate. ATPase activity is a function of myosin heavy chain composition, where muscle fibres containing myosin heavy chain type IIx are slightly faster than type IIa, and both types IIx and IIa are considerably faster than type I fibres.[19,32] To examine the interference effects on such muscular enzymes, Bell et al.[19] split 45 men and women university students into four different groups; S, SE, endurance (E) and a control group. The S group performed a combination of upper and lower body lifts, ranging from 72% to 84% of 1RM, for 3 days/week. The E training consisted of continuous bicycle ergometry 2 days/week, progressing from sessions of 30–42 minutes, and a third day of interval training for 3 minutes at 90% $\dot{V}O_{2max}$ alternated with 3 minutes of recovery, progressing from 4 to 7 sets. Although both SE and S increased myofibrillar ATPase activity, the S group has a significantly ($p < 0.05$) higher increase in this enzyme.

Sustained aerobic exercise not only affects the rate of force development, but also decreases peak power development because the fast twitch muscle fibres used in explosive movement, those containing myosin heavy chain types IIa and IIx, are not recruited to the same extent in low-intensity exercise.[33] Thayer et al.[34] followed subjects involved in distance training for over a decade to find that such aerobic training actually causes transformation of these type II fibres to accommodate an increasing proportion of slow-twitch fibres. While strength training has also shown shifts in fibre type composition,[35] the transformation occurred from type IIx to type IIa rather than to the increased type I proportions seen from aerobic training. This unfavourable recruitment of slow-twitch fibres and resultant decrease in the percentage of fast-twitch fibre cross-sectional area compromises strength and speed capabilities.

An important aspect of high-intensity conditioning, such as sprinting or interval training, over prolonged, endurance training is the increase in the functional properties of fast-twitch muscle fibres relative to the slow-twitch fibres. Although the proportions of muscle fibre types are determined principally by inheritance, the absolute content of fast myosin heavy chains can be altered via the hypertrophy from more relevant forms of conditioning such as sprinting.[36-38]

2.2 Endocrine Considerations

The consequences of endurance training extend beyond neuromuscular deficits to also produce a net catabolic effect on muscle tissue. This net catabolism is generally the result of decreased anabolic hormone release or activity and an increased catabolic hormone release. Kraemer et al.[21] arranged 35 army men into one of four groups; S, SE, E and a group performing endurance training with only upper-body strength exercises. In an attempt to determine the effect on hormonal concentrations and skeletal muscle properties, the subjects underwent training 4 days/week for 12 weeks. The E training consisted of 2 days of 40 minutes of continuous exercise at 80–85% $\dot{V}O_{2max}$ and 2 days of interval training at 95–100% $\dot{V}O_{2max}$. The S training was divided into 2 days that focused on strength development and 2 days that targeted hypertrophy. There was a significant ($p < 0.05$) increase in the exercise-induced and total cortisol response in SE. In contrast, S had a decreased exercise-induced cortisol response by week 8 and an increased testosterone response to exercise ($p < 0.05$), promoting a favourable anabolic environment. The authors concluded that the response of the SE group was due to the extreme stress of adrenal activation from the combined modes of such high-intensity exercise and has led to a type of overtraining response.

Another study by Bell et al.[39] also showed no significant change in testosterone in any training method. This study examined the effects of 16 weeks of concurrent training on testosterone, cortisol and 1RM leg press. Twenty-two men and women rowers were placed in the S or SE group. The S group trained three times/week at an intensity of 65–85%, while the SE group added 30–50 minutes of continuous rowing 2 days/week and 1 day of interval rowing at 90% $\dot{V}O_{2max}$. This study also revealed a significant ($p < 0.05$) decrease in cortisol in the S group after week 8, while the SE exposure to this catabolic hormone continued to rise until the end at week 16. The previously mentioned study by Bell et al.[19] also found increased cortisol in the SE group. These authors also suggest that the addition of strength training to an endurance programme may help maintain normal levels of testosterone.

2.3 Overtraining

Overtraining is the long-term decrement in performance resulting from excessive volume and intensity of training. Restoration of such performance capacity may take anywhere from several days to several weeks.[40] The continuum of overtraining definitions and associated symptoms are outside the scope of this review. However, if an athlete introduces sustained aerobic training without a subsequent decrease in other activities, the stage is set for overtraining. Exercise prescription must consider that sustained aerobic exercise, when combined with the daily rigors of sport and anaerobic modes of preparation, may result not only in suboptimal hormonal profiles but also other factors associated with overreaching in sport.[19,21,40]

With the greater volumes of work that accompany distance training, energy substrates are depleted and joints are placed under repetitive stress. Oxidative stress is also increased and may negatively affect muscle protein turnover, resulting in atrophy of muscle fibres.[41] These factors have all been implicated as possible mechanisms of overtraining[40,41] and such negative responses create an interference pattern, preventing adaptation to strength and power training.

Insufficient recovery, both metabolically and biomechanically, is a central factor to this continuum of overtraining. It can lead to residual fatigue, resulting in a diminished ability to develop tension during powerful movements. This ability of the muscle to generate tension during training is a critical factor in producing optimal power.[42] A reduced capacity to develop power from excessive training volumes may also jeopardise skill acquisition by reducing the quality of execution, and thus motor learning.[43-45]

The addition of distance training to a power athlete's training programme may not only put the individual at risk for injury but also may attenuate any physiological gains and retard skill development.

3. The Benefits of Aerobic Training for Anaerobic Athletes

Coaches who have their athletes perform slow, long-duration exercise often support this practice by referring to the necessity of building an aerobic base.[17,18] This confusion most likely arises from the long duration of activity in lactic cyclic sport. Although aerobic fitness is required, to some extent, the optimal method of conditioning is not through traditional endurance training.

3.1 Improved Recovery

Perhaps the reason that many coaches include distance training in power athletes' regimens would be an improved recovery rate between bouts of exercise or between days of competition. One of the physiological mechanisms of this recovery ability is the increase in capillarisation from aerobic training, improving the delivery of oxygen to the muscle and expediting the removal of metabolic byproducts.[46] Additionally, muscle mitochondrial density increases with endurance training, supporting the aerobic metabolic system.

Although oxidative phosphorylation is not the dominant energy system for a power athlete, oxygen availability may limit the ability to replenish PCr stores.[47] Athletes with higher levels of $\dot{V}O_{2max}$ have shown an increased ability to resynthesize PCr following repeated bouts of high-intensity intermittent exercise.[48,49] Although these studies did not discuss how these athletes achieved such high levels of aerobic fitness, Tomlin and Wenger[50] suggest the following three mechanisms for aerobic fitness to enhance recovery from high-intensity intermittent exercise: (i) an increased aerobic response to the excess post-exercise $\dot{V}O_2$; (ii) an improved lactate removal; and (iii) an enhanced PCr regeneration. Unfortunately, this review did not extensively cover the optimal training methods to obtain such aerobic benefits.

In a study using Israeli National basketball team members, Hoffman et al.[51] found no correlation between $\dot{V}O_{2max}$ and the fatigue index in either the Wingate Anaerobic Power Test ($r = -0.23$) or the line drill ($r = 0.01$), a common basketball conditioning drill lasting around 30 seconds. Little to no correlation was observed between $\dot{V}O_{2max}$ and heart rate recovery after the Wingate Anaerobic Power Test ($r = -0.22$) or after measurements between three consecutive line drills ($r = -0.04$, $r = -0.19$ and $r = -0.30$), respectively. However, there was an increasing correlation between the aerobic capacity and heart rate recovery with subsequent bouts of the line drill. Because the total duration of anaerobic exercise only lasted 5.5 minutes, including both work and rest periods, the authors concluded that more studies should be performed to examine the relationship of these variables under situations that more closely resemble the length of competition.

Wisloff et al.[3] examined this more relevant relationship between aerobic capacity and performance in games by comparing two professional teams from the Norwegian soccer league. The authors discovered that elite soccer players with a high $\dot{V}O_{2max}$ had significantly higher ($p < 0.05$) performance results. However, it is difficult to completely credit $\dot{V}O_{2max}$ for the team's superior performance because these more successful athletes also possessed higher values of bench press, squat and vertical jump. The study also explained that their aerobic fitness was achieved purely through simulated games, rather than using long-distance training. Research on the effects of high-intensity interval training supports this distinction. This type of training results in similar aerobic metabolic adaptations, yet has the benefit of stimulating anaerobic metabolic adaptations as well.

Dolgener and Brooks[52] reported that 6 weeks of continuous training or interval training resulted in similar increases in $\dot{V}O_{2max}$ and decreases in 1-mile run time. Bhambhani and Singh[53] further found that continuous training and interval training would elicit the same adaptations if the total amount of work was equal. Interval training, however, also leads to improved anaerobic capacity and anaerobic power output, whereas continuous endurance training only influences the aerobic energy system.[54]

3.2 Enhanced Glucose Uptake

While the recovery of PCr mentioned in section 3.1 is significant for repeated high-intensity efforts, glycogen storage is also crucial in a number of sports, particularly in events such as soccer that involve numerous high-intensity efforts against a backdrop of sustained low aerobic activity.[55] Repeatedly depleting muscle glycogen with sustained distance training leads to subsequent increases in resting muscle glycogen levels.[56,57] However, this glycogen depletion and resulting supercompensation may also be achieved through interval training and other high-intensity conditioning methods. Besides a review by De Feo et al.[58] that describes these comparable metabolic benefits, a more recent study by Stepto et al.[59] compares high-intensity interval cycling of 8 × 5-minute bouts to longer, continuous rides of 60 minutes. The study found average carbohydrate oxidation rates of 340 and 350 μmol/kg/min for the 5-minute interval group and cyclists training continuously for 50 minutes, respectively ($p < 0.01$).

Another cellular mechanism for enhanced glucose uptake in aerobically trained athletes is an increase in muscle glucose transport protein-4 (GLUT-4). Kraniou et al.[60] examined muscle samples from six untrained, male subjects on 7 consecutive days of 60-minute bouts of cycling at 75% of $\dot{V}O_{2max}$. Not only was there an increased transcription of the GLUT-4 protein following each exercise bout ($p < 0.05$), but there was an overall gradual accumulation of the GLUT-4 protein. While no studies have compared the aerobic effects of high-intensity interval training versus continuous exercise on the GLUT 4 protein, a key skeletal muscle kinase in this process, the adenosine monophosphate-activated protein kinase, is activated at exercise of intensities >60% of $\dot{V}O_{2max}$.[61]

3.3 Improved Body Composition

Many other supporters of slow, continuous exercise may quote the prevailing notion that such low-intensity exercise is advantageous for athletes that need to lose body fat. This goal of improved body composition is important because athletes may benefit from a lower body fat percentage to ensure general overall health, as well as minimising excess, nonfunctional weight. However, the use of distance training does not account for the significantly greater post-exercise energy expenditure and fat utilisation of high-intensity interval training.[62] A study by Tremblay et al.[63] directly compared the metabolic effects of interval training with those of distance training. Despite its lower energy cost, the decrease in the sum of six subcutaneous skinfolds induced by an interval training programme was 9-fold greater than the group performing 30–45 minutes of sustained aerobic exercise. These results may be explained by the significantly ($p < 0.05$) greater activity of muscle 3-hydroxyacyl coenzyme A dehydrogenase activity, a marker of β-oxidation enzyme, after the interval programme when compared with the distance training group.

A more recent study by Chilibeck et al.[64] looked at the mitochondrial changes in the gastrocnemius-plantaris muscles of 20 male rats after 6 days/week of exercise training for 12 weeks. Half of the group performed continuous, submaximal, endurance treadmill running, while the other half engaged in intermittent, high-intensity, interval running. While the mitochondria in both groups increased the rate of fatty acid oxidation, the increase associated with the intermittent, high-intensity exercise training was significantly greater than that achieved with the continuous exercise training ($p < 0.05$). These studies indicate that high-intensity exercise favours negative energy and lipid balance to a greater extent than exercise of low to moderate intensity.

3.4 Active Recovery Day

Long, slow distance training may also be frequently utilised in an attempt to improve recovery after games or demanding workouts. There is no current evidence that recovery exercise will reduce delayed onset muscle soreness or markers of muscle damage. A study by Martin et al.[65] compared the effects of 30 minutes of running at 50% $\dot{V}O_{2max}$ versus passive recovery in the 4 days following heavy eccentric muscle damage. The results revealed that the recovery modes had no effect on voluntary and electrically evoked torque recovery time courses in trained individuals ($p < 0.05$). The authors speculated that from 2 to 4 days after the eccentric exercise, damage to force-generating structures could account for the remaining torque deficit.

Proponents claim that local circulation increases from sustained exercise can improve recovery by removing cellular debris, increasing nutrient delivery, and hence tissue repair following a competition or high-intensity training session.[16-18] This haemodynamic mechanism is a legitimate consequence of distance training; however, almost any form of exercise can dilate the blood vessels of skeletal muscle, causing an increase in blood flow. A review by Hughson[66] on the effects of exercise on blood flow concludes that vasodilation occurs quickly after the onset of activity and is dependent on intensity of exercise. These two conclusions question the use of prolonged, low-intensity exercise over shorter periods of exertion when the goal is a transient increase in circulation to improve delivery of nutrients and clearance of unwanted metabolic byproducts. There is no scientific evidence or practical reasoning that explains the use of distance running over other types of conditioning to achieve an increase in circulation. Light technique work in the weight room, an easy sport skill training session, or even an enjoyable, unrelated cross-training session would be much more efficient for these active recovery days by increasing local circulation while improving athleticism and avoiding unnecessary interference of strength and power gains.

3.5 Preparation of Supporting Structures

Another popular argument for the use of sustained endurance training is to build a musculoskeletal foundation for future higher intensity movements. Connective tissue, such as ligaments, cartilage and tendons that provide this support may require several weeks or months of high-volume loading for hypertrophy. On the other hand, muscle fibres hypertrophy in mere weeks and more quickly begin to achieve the density required for increased force production.[35,67,68] Therefore, exercise prescription must account for connective tissue's slower rate of adaptation to both avoid injury and optimise the ability to generate power. In many athletes who train at an accelerated pace or without proper progression, the development of the ligamentous-joint complex has been suggested as the limiting factor in performance.[69] By increasing the quantity and quality of connective tissue, an athlete can improve the transmission of force, the core aspect of any movement.[70]

There are many other choices to prepare the body's supportive structures through higher volume exercise, such as employing a greater number of sets that involve shorter distances or fewer repetitions. An example is high-volume interval training at moderate intensities, which may provide a conditioning option to improve soft tissue characteristics, while avoiding interference.

Another option is using the progressively more intense, athletic movements found in sports, such as jumping or sprinting, which can actually improve the body's supporting structures by increasing the muscle-tendon complex's elasticity and ability to store energy. At these higher force-production levels, a study by Kubo et al.[71] showed an increased compliance and elasticity in the connective tissue of sprinters compared with controls ($p < 0.05$). This study specifically evaluated the tendon and aponeurosis of the vastis lateralis and medial gastrocnemius muscles, muscles directly involved in the transmission of force into the ground. In another study, Kubo et al.[72] found that these same musculoskeletal structures of long-distance runners were significantly less compliant and absorb less elastic energy than even untrained individuals ($p < 0.05$). Such soft tissue behaviour has significantly lower values on the vertical jump when compared with the sedentary controls ($p < 0.05$). Although this area needs to be explored more extensively, sustained aerobic training may actually provide a directly negative adaptive stimulus on connective tissue and a resulting decrease in force production.

4. Conclusions

Sustained aerobic training, at even low frequencies and volumes, has been shown to clearly interfere with strength and power development, as well as contribute to risk of overtraining and an ineffective motor learning environment. Despite these negative adaptations, at all levels of competition, power athletes continue to utilise sustained aerobic training. All of the potential benefits of aerobic training, such as increased rate of PCr regeneration and improved connective tissue properties, can be attained by carefully prescribed interval training and, in some cases, light technique work or sports skills development.

While interval training has been discussed as a general alternative to distance training, more specific guidelines will be outlined below. The suggested protocol for interval training will focus on the aerobic system, as this is the nature of the review, and other vital conditioning aspects, such as lactate threshold training and speed development, will be reserved for future discussion. Intervals should be <30 seconds to avoid significant lactate accumulation, as well as resemble the shorter duration of most athletic movement. Between these work intervals, the athlete should perform active rest, at about half of the speed of the more intense intervals, to continue to oxidise anaerobic metabolites and maintain a relatively low level of lactic acid in the muscle tissue. Although the work-to-rest ratio may be manipulated for certain situations and desired goals, a ratio of 1 : 1 has been suggested to sustain a higher aerobic stimulus, while minimising lactate accumulation. We believe that any further specificity of an interval training programme should be adjusted according to the individual athlete's profile and the time motion analysis of their sport.

Although there is no specific training programme that will work for every athlete, this review should help eliminate distance training from a power athlete's programme and allow full benefit from other aerobic conditioning options, such as interval training.

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