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Toward an Understanding of Power

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UNDERSTANDING POWER CAPACITY and how it can be created is one of the primary keys to optimizing athletic performance. Power should not be confused with strength. Power is the capacity to do a given amount of work as rapidly as possible. By this definition, power includes the elements of strength and speed. It is dynamic strength coupled with movement speed. Speed is the ability to apply force rapidly when snatching, cleaning, throwing, or sprinting.

One of the major advantages of being physically powerful is the ability to accelerate. An athlete who is powerful can get up to full speed faster than an athlete who is just strong. Being able to accelerate is not the same as simply being fast. Acceleration refers to the ability to change velocity quickly. Velocity is speed in a given direction. For instance, in cleaning a weight, the velocity of the bar is equal to its speed and the upward direction in which it moves.

One of the purposes of weightlifting, and perhaps the main one, is to train and condition the athlete to generate maximum muscular force at higher and higher movement and speed. This is dynamic power in action. Thus, in competition, when all other factors are equal, power is the deciding factor between winning and losing. Strength times speed equals power. In metric terms, power is defined as work per unit of time measured in watts (1 W = 6.12 kp m/min and 1 kp = 9.60665 N). Power values for strength athletes are best expressed in watts of power per kilogram of body mass.

In the sport of powerlifting, the squat, bench press, and deadlift have been designated as power lifts. Technically, this is incorrect and misleading, since they are not true power lifts. Only the Olympic-style lifts (snatch and clean, and jerk) rightfully qualify as power lifts. In powerlifting, muscle force is required, but power output, as measured in watts per kilogram of body weight, is low in comparison to that generated in Olympic-style lifting. This is easily illustrated by comparing the power values for world record lifts made by 2 former world champions, powerlifter Doyle Kenady (Figure 1) and weightlifter Alex Pisarenko (Figure 2).

Kenady, with a body weight of 140 kg, executed a 405-kg deadlift. Approximately 2 seconds was required for him to lift the bar and weight 0.40 m off the floor and stand erect. Pisarenko, with a body weight of 120 kg, executed a 265-kg clean. It took him 0.90 seconds to clean the weight and stand up. The bar and weight traveled 0.90 m from the floor.

In comparing the power values of the world record lifts made by these former champions, we see that Pisarenko's 265-kg clean generated 21.64 W per kilogram of body mass, and Kenady's 405-kg deadlift produced 5.57 W per kilogram of body pass. As this example illustrates, the so-called power lifts are actually strength lifts. Conversely, the snatch and clean are true high-velocity power lifts. This tells us that athletes need to concentrate more on snatching and cleaning and less on the

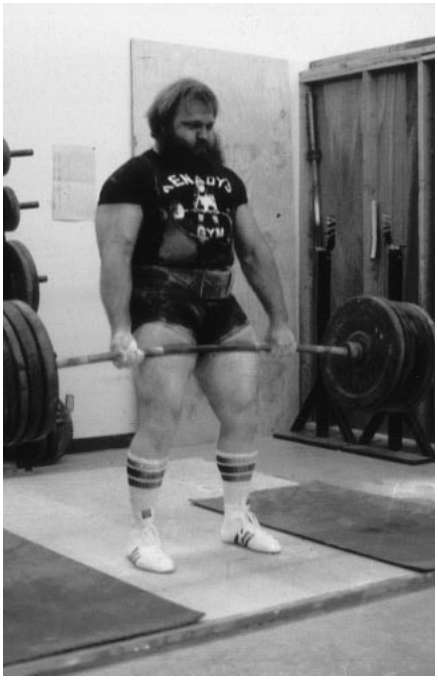


Figure 1. **Kenady (deadlift)**
140 kg (body mass)
405 kg (mass lifted)
.40 m (height of pull)
2 sec. (time to execute lift)

WORK=FORCE X DISTANCE
where
force=mass lifted
distance=gravity x height of pull
gravity=9.8 m/s^2
Work=(405 kg)(9.8 m/s^2)(.40 m)
Work=1587.6 (N•m)

POWER=WORK/TIME TO EXECUTE LIFT
Power=1587.6 (N•m) 2 sec
Power=793.8 (N•m)/s or watts
Power=793.8 watts/140 kg=5.67 watts/kg body mass

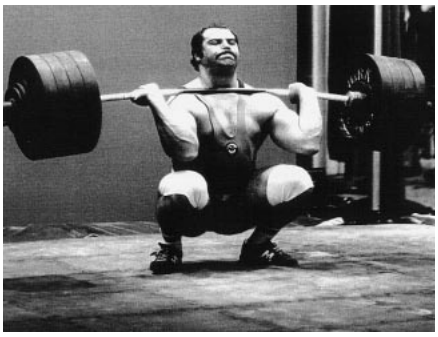


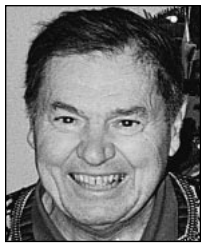
Figure 2. **Pisarenko (clean)**
120 kg (body mass)
265 kg (mass lifted)
.90 m (height of pull)
.90 sec. (time to execute lift)

WORK=FORCE X DISTANCE
where
force=mass lifted
distance=gravity x height of pull
gravity=9.8 m/s^2
Work=(265 kg)(9.8 m/s^2)(.90 m)
Work=2337.3 (N•m)

POWER=WORK/TIME TO EXECUTE LIFT
Power=2337.3 (N•m) .9 sec
Power=2597 (N•m)/s or watts
Power=2597 watts/120 kg=21.64 watts/kg body mass

bench press and deadlift (and bodybuilding). Training with lifts such as the compound lift (i.e., power clean to squat to push press), develops full-body athletic power, speed, mobility, and flexibility as no other form of strength training can. And when combined with sports-specific technique training, optimal transfer of these variables occurs.

Peak power values for world-class weightlifters in lighter classes average about 30 W. This means that lighter lifters have much higher strength-to-body-weight ratios compared with heavier lifters. Kilogram for kilogram, they are stronger lifters. Strength coaches should know the power values for the athletes they train. The values can serve as an accurate measure of improvement. ▲



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