

# Roles of Maximal Strength and Rate of Force Development in Maximizing Muscular Power

Christopher Taber, MS, Christopher Bellon, MA, Heather Abbott, MEd, and Garrett E. Bingham, MA  
Center for Excellence for Sport Science and Coach Education, Department of Exercise and Sport Sciences,  
East Tennessee State University, Johnson City, Tennessee

## ABSTRACT

THIS BRIEF REVIEW ENCOMPASSES THE ROLE OF MAXIMAL STRENGTH AND RATE OF FORCE DEVELOPMENT IN THE PRODUCTION OF MUSCULAR POWER. IT BEGINS WITH THE INVESTIGATION OF POWER OUTPUT AND ITS IMPORTANCE FOR SPORT. AFTER THIS BASIS FOR POWER PRODUCTION, THIS REVIEW EXAMINES BOTH MAXIMAL STRENGTH AND RATE OF FORCE DEVELOPMENT EFFECTS ON THE DEVELOPMENT OF OPTIMAL POWER OUTPUT. FINALLY, A RATIONAL WHY MAXIMIZING RATE OF FORCE DEVELOPMENT DURING THE COMPETITION SEASON TO ACHIEVE SUCCESS IN SPORT IS PROVIDED.

## INTRODUCTION

### WHY IS POWER IMPORTANT?

It has been previously suggested that power outputs are perhaps the most important characteristic impacting sport success (54). The reasoning behind this concept is that power outputs have demonstrated a strong relationship with

improved performance of various sport tasks such as sprinting (65,66), jumping (20,34,38,40), change of direction (41,48,52), throwing (36,37), and weight-lifting movements (11,26). Optimization of power outputs at specific times of the training year is often a primary goal when using periodization strategies (32,55,59). Therefore, enhancing these sport skills through the augmentation of peak power at particular times of the competitive season may increase an athlete's preparedness, thus giving them a greater probability of winning an event.

A counterargument to this concept is often made with respect to endurance events, as peak power may not be a vital performance characteristic in tasks such as running, cycling, or swimming. However, multiple studies have shown that the average power output for the duration of a distance event, and even peak power during the final sprint, may play a critical role in determining the outcome of a race (42,44,58). Additionally, literature exists suggesting that levels of peak power outputs can differentiate athletic performance (4,6,7,9,21,25,30). As such, the development of muscular power is critical

across the spectrum of sport from aerobic to anaerobic sports.

### WHAT IS POWER?

Power is a work rate expressed by the equation,

$$Power = Force \times Velocity.$$

The power equation reflects the 2 components that must be considered when attempting to maximize total power output. The first component is velocity, which is directly related to momentum. The second component is force, which is associated with momentum through impulse.

$$Power = Force \times Velocity$$
$$Force \times \Delta Time = Mass \times \Delta Velocity$$

(Impulse) (Momentum)

Velocity. The concept of examining changes in momentum to understand the velocity component of the power equation is used because most sport activities involve accelerating a mass. When the mass in question is an

### KEY WORDS:

strength; rate of force development; power development













