

SPECIFICITY FOR SPORT

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INTRODUCTION

One of the main principles utilized in physical training is the concept of specificity. In other words, an individual needs to train in a manner that is most like the way in which they want to perform. To perform better at distance running events, one must run long distances; to be stronger, one must lift heavy weights; to be more explosive and powerful, one must perform explosive lifts or drills. While much of sport specificity in training for a particular sport is addressed by the sport coach, there are aspects of specificity that can be developed more effectively in the weight room setting.

RESEARCH FINDINGS

This specificity concept is supported by the physiological changes that are known to occur in the body with various types of resistance training, both normal and explosive. By definition, resistance training includes performing various weight training exercises for a specified number of repetitions (depending on the main desired outcome) generally for multiple sets, with a defined rest period between those sets (again depending on the main desired outcome). Possible desired outcomes include muscular endurance, muscle hypertrophy (size increases), strength, and power, and the emphasis would vary based on the demands of the sport and the time of year in terms of training and competition. The sets, reps, and rest periods vary among these desired outcomes, and a general outline for maximizing each desired outcome is presented in Table 1.

Table 1. General Set/Rep/Rest Period Guidelines for Various Program Goals in Resistance Training

	Endurance	Hypertrophy	Strength	Peak Strength	Power (explosive)
Sets	3-6	3-10	3-5	3-5	3-5
Reps	12-15	8-12	4-6	1-3	4-7
Rest	30 sec-1 min	1-1.5 min	2-3 min	5+ min	3+ min

Explosive training can encompass many things, from plyometrics, which are performed only with body weight, to Olympic lifts, which are generally performed with an amount of weight that is approximately 70-80% of one's maximum lifting capabilities (1RM), all with the ultimate goal of improving power production. Other explosive resistance exercises that fall between plyometrics and

Olympic lifts would include jump squats and bench press throws, which are typically performed with resistances that are 30-60% of one's 1RM, and are only performed for a maximum of 4-7 repetitions to ensure that technique does not fail due to fatigue. This approach is different from the other program goals, since with those goals the lifter will commonly be fatigued or nearly fatigued after each set with the recommended number of repetitions provided in the table.

In terms of the muscular system, most strength training programs result in an increase in muscle cross-sectional area and subsequently, overall muscle mass, due to an increase in the amount of protein in the individual muscle fibers. Some types of programs are better at this than others, such as those involving higher repetitions and shorter rest periods (Tesch and Larsson, 1982). Investigators have found that programs utilizing sets of 10RM with a short (1 min) rest between sets also result in the greatest increases in growth hormone, a main hormone for muscle tissue growth and repair (Kraemer et al., 1990). In addition, resistance training stimulates muscle fibers to alter their properties to allow them to be more functional in sport movements. This is shown by fiber type shifting, where some muscle fiber types that are rarely used take on the characteristics of more heavily recruited fiber types so they can then be recruited and add to the overall force output (or endurance) of the muscle (Staron et al., 1990). For example, with endurance training, muscle fibers shift towards a more "slow" profile, where more of the enzymes that are used in the long-term energy pathways for endurance activities are stored in the muscle fibers (Saltin and Gollnick, 1983), thereby allowing those muscle fibers to increase their endurance capacity to an extent. On the other hand, heavy resistance training results in a shifting of the rarely-used fast twitch "B" fibers to the heavily-used fast twitch "A" fibers, allowing more fibers to be called upon to produce force for fast, high force, or even explosive movements (Staron et al., 1990). Therefore, if an athlete requires muscle endurance, strength, or size, there are very specific training patterns that must be used to ensure that the body is adapting to the training properly and altering itself to perform better in the sport or activity.

Regarding the neural system, many adaptations occur even more quickly than those occurring in the muscular system, which is why one can observe strength improvements well before there are obvious increases in muscle mass. Muscle strength and power are highly dependent on the neural system and thus, training must also focus on the neural system so strength and power can be maximized. For example, one investigation (Hakkinen et al., 1985) showed that when a group of study participants trained with normal heavy resistance training, peak strength improved but not the rate of force development, which is how quickly that peak strength could be reached. A second group in the same study trained explosively with a jumping movement, and dramatically improved



their rate of force development but not peak strength at all. A different investigation showed that 12 weeks of training with jump squats vs. plyometrics vs. heavy resistance training resulted in greater improvements in sprint speed, vertical jump height, short-term anaerobic capacity, and agility in the jump squat group compared to either of the other groups. All the variables tested are evident in most sport movements and generally have some type of explosion or speed characteristics, which partly explains the superior performance of the jump squat training group. These performance increases occurred because the known neural training adaptations which include increases in motor unit (the muscle fibers and the nerve that controls them) recruitment efficiency and synchronization, as well as increased overall recruitment of muscle fibers in general because the firing rate of the nerves increase. Also, the sensitivity of the protective reflexes is diminished, which allows the muscle to produce more force or power before any type of inhibition occurs (Komi, 1986).

Interestingly, all of these adaptations are very training-specific, as demonstrated in a classic study (Thorstensson et al., 1976). Subjects were trained on the squat exercise but tested in the squat, leg press, and leg extension exercises, all of which utilize the same general primary muscles. The greatest % improvement was shown in the squat test, which is logical considering the subjects were trained in the squat. However, the same level of improvement was not seen in the leg press or leg extension tests, which seemed to get worse the less similar the testing exercise was to the training exercise. These results illustrate the specificity principle clearly, reflecting the neural specificity of movement and learning of relatively unique force production patterns that only partially carry over to other similar movements.

CONCLUSION

In summary, the specificity principle states that training must be similar enough physiologically to the desired aspects of physical performance in order to make any improvements in performance. This involves overloading the physiological systems sufficiently to induce an adaptation of those physiological systems. The program must be designed with specific performance goals in mind and with enough variety to ensure continued adaptation of the body. The performance goals will dictate the type of training that is engaged in. While every possible type of sport movement cannot be simulated in the weight room, some general basic movements that are central to sport and to many lifting exercise can be trained, which will induce the neural and muscular changes that do not disappear when one steps onto the playing field or court.



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