

January 2011

# Is Training to Failure a Safe and Effective Method for Improving Athletic Performance?

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## Recommended Citation

Khamoui, Andy V. and Willardson, Jeffrey, "Is Training to Failure a Safe and Effective Method for Improving Athletic Performance?" (2011). *Faculty Research and Creative Activity*. 23.  
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## **Point/Counterpoint: Is Training to Failure a Safe and Effective Method for Improving Athletic Performance?**

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### **Pro**

Training to failure involves the inability to perform a lift beyond the sticking point as a result of fatigue induced by previous muscular work (i.e., consecutive repetitions) (1). Although failure may be achieved in a few repetitions using high loads (~95% 1 repetition maximum [RM]), light to moderate loads (6RM– 15RM) or percentages of these loads (e.g., 80% 10RM) are typically used when training to failure (1,3,4). In practice, this will require either partner assistance from a spotter (1) or load reductions (3) to overcome the sticking point on the terminal repetitions of a set. This approach to resistance training has been and continues to be used among lifters of varying training levels with the intended purpose of acquiring favorable adaptations, particularly muscle hypertrophy (5).

Although enhanced muscle size has commonly been the desired outcome among practitioners of training to failure (e.g., bodybuilders), evidence exists supporting its application for improved strength, power, and muscular endurance, characteristics considered more relevant to athletes. For instance, Izquierdo et al. (3) assessed the impact of an 11-week resistance training program using repetitions to failure versus nonfailure on strength, power, and muscular endurance in national-caliber athletes. Volume was equated between the failure and the nonfailure groups; however, the group performing sets to failure used a set and repetition design that required load reductions when the athlete paused for more than 1 second or could not overcome the sticking point on terminal repetitions of a set. Both protocols improved strength (1RM bench press and 1RM squat) and concentric power (bench press and squat at 65% 1RM) to a similar degree. However, muscular endurance performance on the bench press at 75% 1RM was significantly greater in the nonfailure group.

Another study examined the effect of a 6-week upper-body training program with sets to failure or nonfailure on 6RM bench press strength and 6RM bench throw power in elite junior athletes (1). Total volume was also equated between the failure and the nonfailure groups; however, the failure group performed a higher number of repetitions per set (6 versus 3) but fewer total sets (4 versus 8) such that assistance by a spotter would be required on terminal repetitions. The investigators reported significantly greater gains in 6RM bench press strength and 40-kg bench throw mean power after training to failure compared with the nonfailure group. Taken together, both studies indicate that short-term resistance training (<11 weeks) using repetitions to failure has the potential to elicit positive performance adaptations.

It is important to note that among the limited investigations controlling for total volume,

those that did not show a clear benefit of training to failure over nonfailure still reported similar performance improvements in muscular strength and power (2,4). Very few studies to the author's knowledge have reported substantial performance decrements relative to a nonfailure program. In other words, a convincing body of evidence against the training to failure approach has not been documented to the degree where it can be advised against outright.

The studies that reported augmented performance after training to failure indicates that it can be used favorably. Obtaining positive adaptations with training to failure likely relates to its application and manipulation within a training program. An excellent review by Willardson et al. (5) addresses training to failure because it relates to program design. The authors state that repetitions to failure should be performed for a 6-week cycle and then alternated with a nonfailure training period of equal duration. The intended purpose of such an approach would be to maximize benefits from training to failure while minimizing injury risk and overtraining. It can also serve as a method of introducing variation into an athlete's training program.

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## Con

Resistance exercise prescription involves the manipulation of several variables. The American College of Sports Medicine indicates that the primary prescriptive variables include muscle action, loading, volume, exercise selection, exercise order, rest intervals between sets, velocity of muscle action, and frequency of sessions (2). How these variables are structured over time determines specific muscular adaptations that are associated with measurable characteristics, such as power, strength, hypertrophy, and localized muscular endurance. Another prescriptive variable that might be relevant in the process of achieving increases in these characteristics is whether sets are performed to the point of repetition failure.

There have been relatively few scientific studies that have directly examined failure versus nonfailure training, and the challenge of equating intensity and volume is a key issue that complicates study of each approach independently. However, the limited cross-sectional and longitudinal interventions that have examined each approach have given initial indications as to when each approach might be implemented based on the training objective. It is the opinion of this author that with the exception of hypertrophy-oriented training, athletes should not perform sets to failure, and even if the goal is hypertrophy, a combination of failure and nonfailure approaches is best (5).

With few exceptions, very few athletes have a need for hypertrophy-oriented training that could be facilitated through the periodic incorporation of repetition failure sets and other techniques, such as assisted repetitions and descending sets (5). For most athletes, the greatest performance transfer results when resistance training is directed toward localized muscular endurance, strength, or power. With resistance training comprising only 1 component of a comprehensive preparation schedule, the incorporation of repetition failure sets may increase fatigue and subsequent recovery time, which may interfere with the effectiveness of other higher priority conditioning drills (e.g., plyometrics) and sports-specific skill practice. However, it must be considered that proponents of repetition failure training often advocate a single set to failure approach that may not interfere with other conditioning priorities, as might be the case with a multiple set to failure approach.

During the preseason and in-season training phases, strength and conditioning coaches may have a limited time to spend with athletes. In such cases, the resistance training prescription must be carefully planned and executed for the greatest returns. During such phases, development of power is often the primary focus, and maintaining high velocities and strict technique is of paramount importance during all training exercises. In this case, the use of repetition failure sets would be counterproductive because of declines in velocity (and acute power output) (3,4) and potential deterioration in technique with increasing levels of fatigue, which could magnify the risk of injury.

Therefore, when power is the objective, all exercises should be performed for submaximal repetitions (e.g., 1–6) with a given load (e.g., 30–70% 1RM) and instituting

longer rest intervals between sets. Research has indicated that velocity and acute power output decline after approximately 4–6 repetitions per set (3,4). Research has also indicated that maintenance of high power output is best achieved when resting 3–5 minutes between sets (1). However, rather than passively resting between sets, athletes may perform exercises for uninvolved muscle groups (or antagonistic muscle groups) to improve time efficiency.

In summary, repetition failure training is best applied to hypertrophy-oriented training. However, with a few exceptions, most athletes should not waste time on hypertrophy-oriented training and the associated incorporation of repetition failure sets. Most athletes will derive greater sports-specific transfer from training programs directed toward localized muscular endurance, strength, or power development, the specific objective being dependent on the individual needs and the phase in the yearly training plan.

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