Should you train to failure every set?

Contributed by Robbie Durand
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-Dorian Yates Blood & Guts Workout Routine

"What kind of half-ass set was that?" asks your training partner. "You didn't train to complete muscular failure! How are you going to get big if you don't train to complete muscular exhaustion! You could of did 2 more reps you big pus! What's the matter, did you take your girlfriends birth control pills instead of your GAKIC?" Keep talking smack you think to yourself, continuously training to failure may result in reduced anabolic hormones and may lead to overtraining! According to the newest study in the Journal of Applied Physiology training to muscular failure each set leads to reductions in anabolic hormones such as IGF-I and testosterone and caused larger increases in cortisol compared to lifters who don't train to failure. The subjects in the study trained twice a week using a periodized weight training program. One group trained to complete muscular failure for each set while the other group trained did not complete sets to muscular failure. The researchers defined muscular failure when the subjects could not perform a full extension or the weight was paused for more than 1 second during a repetition. At the end of the 16 week study, training to failure over the 16 week study resulted in reductions in circulating IGF-I concentrations and elevations in IGFBP-3 (IGF- Binding Protein 3). In addition, the group that did not train to failure had reduced resting cortisol concentrations and an elevation in resting serum total testosterone concentration. Additionally, the group that did not train to failure had similar increases in 1-repetition maximum strength gains in the bench press, parallel squat, and muscle power output of the arms and legs extensor muscles1. The group that did train to failure did have increased muscular endurance at the end of the study so unless you are preparing for a bench press competition for reps, training to failure might be the way to go. If you are trying to maximize size, than not training to failure may lead to enhanced testosterone and lower catabolic activity such as reduced cortisol. The reduction in anabolic hormones (IGF-I and testosterone) from training to failure goes against decades of advice to train to failure for maximal muscle growth. Although Dorian Yates trained to failure does not mean you should train to failure. Training to failure each set may lead to overtraining and lowered testosterone and IGF-I levels.

IGF-I and IGFBP-3(IGF-I Binding Protein 3)

In skeletal muscle, IGF-I can increase the uptake of glucose and amino acids enhance protein synthesis and suppress protein breakdown3, 4. Moreover, IGF-I stimulates muscle growth by increasing the stimulation of satellite cells5. IGF-I is produced in many tissues, but the main source of circulating IGF-I is the liver, and the main regulators of hepatic IGF-I synthesis are GH and nutrient intake6. Additionally long term resistance training that is of sufficient intensity and volume has been shown to increase IGF-I responses 7, 8, whereas overtraining has been shown to decrease IGF-1 responses9, 10.

STOP! Step Away from the Bar! Your IFGBP-3 Levels are Dropping!

A large fraction of circulating IGF-I is attached to IGF binding proteins.

Approximately 95% of the IGF-I and IGF-II are bound to IGFBP-3, which makes this protein the major carrier of IGF's in plasma. One of the principal functions of binding proteins is to extend the half-life of the IGF's from eight minutes to several hours. In this way, IGFBP-3 acts as a stabilizer, providing a constant level of IGF in the blood2. Serum IGFBP-3 concentrations in humans are relatively constant throughout the day, and this is likely to account for the stability of serum IGF-I concentrations17. IGFBP-3 serves as a storage pool for serum IGF-I. Interestingly, aging which is associated with a loss of lean muscle mass results in reduced secretion of GH and/or production of IGF-I which may contribute to the development of an excess of IGFBP-3 relative to IGF-I in aging19. A rise in IGFBP-3 means the body is trying to maintain IGF-I integrity. It could be speculated that the reason why circulating levels of IGFBP-3 levels rose in the group that trained to failure was to preserve IGF-I levels from falling, however once the training intensity is high for long periods and overtraining is taking place, IGFBP-3 levels drop to rapidly release IGF-I to the tissues. The response of IGFBP-3 has been variable between studies; usually the more exhaustive and strenuous a resistance exercise protocol is the bigger the drop in IGFBP-3 is. For example, IGFBP-3 has been identified as a sensitive marker for overtraining, as IGF-1 levels fall IGFBP-3 decrease to release more IGF-1 in the plasma making it more available12. A significant drop in IGFBP-3 has been reported in overtrained soccer players and volleyball players, suggesting that IGFBP-3 level reflect a neuroendocrine adaptation to heavy exercise13, 14. Kraemer et al. reported that there was no change in IGF-I in response to a resistance exercise protocol in young men but IGFBP-3 levels increased significantly after exercise perhaps preserving IGF-I stability11. So what happens when you start pushing your body too hard? There is a drop in both IGF-I and IGFBP-3. For example, 10 untrained and 10 well trained elite troop soldiers were subjected to 11 weeks of intense physical training. Both the untrained and trained groups had decreases in IGF-I but the IGFBP-3 responses were different. The well trained group had no changes in IGFBP-3 whereas the untrained group had significant drops in IGFBP-3 levels indicating that the untrained subjects were in a more catabolic state17.

Keep Protein Intake High For Enhanced IGF-I Responses

Inadequate protein or energy may be a factor that contributes to a decline in circulating IGF-I during intense training. Protein intake has direct effect on raising IGF-I levels. One study examined the effect of different protein intakes on the regulation of serum IGF-I. Subjects were fasted for 5 days which lead to a huge drop in serum IGF-I levels and were refed three diets of different composition (a normal diet, a low-protein normal energy diet, and a low protein, low energy diet) in the 5 postfast days. Refeeding a normal diet (35kcal/kg/day containing 1.35 g protein/kg/day) raised IGF-I

to nearly 70% to prefast values by the fifth day, while refeeding a protein-deficient isocaloric diet (0.43 g/kg/ day) resulted in a 2-day delay in the upward rise of IGF-I and increased IGF-I to only 50% of control prefast values15. Consuming high protein is essential during any heavy training program. No, a fig-newton is not going to cut it to preserve IGF-I levels!! You need to be consuming some type of protein based supplementation. For example, one study examined IGF-I levels in response to six months of resistance exercise. Total calories were the same between the groups except one group was assigned to a protein supplementation group (2.2 g per kg of bodyweight) and the other a high carbohydrate with moderate protein (1.0 g per kg of bodyweight). The results of the study found that the group consuming protein supplementation had greater increases in plasma concentrations of IGF-I compared to subjects consuming a carbohydrate supplement11. Additionally, Kraemer et al. reported that young men who consumed Mass Fuel two hours before their workout and one-immediate post-exercise had higher IGF-1 levels after exercise on days 2 and 3 post-

exercise14. Essential amino acids (primarily Branched Chain Amino Acids) have been shown to impact serum IGF-I and nitrogen balance to a greater extent than do nonessential amino acids15. One study examined IGF-I and fatigue levels in competitive rugby players before a national tournament. Interestingly, all the rugby players had a decline in circulating IGF-I levels after the match that was lower than adult norms. When energy intake was examined, the total calorie intake was 6% lower than what the were supposed to be consuming and mean protein intake was 1.27 g per kg of bodyweight while recommended protein intake for rugby players is 1.5-2 g per kg of bodyweight. Thus high intensity exercise in conjunction with insufficient calories and protein could have led to the drop in IGF-I levels.

Use Forced Reps, Drop Sets, and Negatives...Occasionally

Training to failure does have its place in your training regimen; you just can't do it every set. Going to failure or using forced reps is kind of like going out with the boys to the bars to drink, its ok once in a while but doing it every night will leave you looking like a Skinny Kid Rock! Although many bodybuilders may think you have to "shock" your body into growth with high intensity exercises such as training to muscle failure or using forced reps is key to muscle growth...to the authors knowledge no research study has ever proven that training to failure is necessary to muscle growth. No bodybuilder gets "big" overnight. The science of increasing muscle mass is similar to trying to get a darker tan. You gradually expose your skin to the sun and your tan darkens, it is not necessary to subject your skin to the most intense sunlight it can withstand up to the moment before blistering. Muscle growth stimulation operates on the same principle. Consequently it is not necessary to operate a muscle to its absolute limit of muscular failure in order to stimulate new muscle growth. The use of forced reps is a tool that can be thrown into your training arsenal but recuperating from forced reps is taxing on the body. One study examined anabolic hormone response over a 3 day period in lifters using 2 types of popular bodybuilding protocols: one trained to maximal exhaustion and the other used forced reps. The total training volume was the same for both groups except the forced reps subjects had spotters assist them for the last 3-5 reps. Immediately post-exercise, there was no difference in testosterone production between the groups but the forced reps group had a higher GH response but also a higher cortisol response. Additionally, the group performing forced reps had a greater decrease in maximal isometric force compared to the maximal resistance group18. So the use of forced reps is a double edged sword, on one hand you get higher GH responses, but on the other hand you also produce higher cortisol and have reduced muscle strength with may lead to overtraining. The ability of your muscle to contract is controlled by your central nervous system. As your nervous system controls your muscles through electrical impulses, overtrained or recently trained muscles require a larger signal to actually complete a contraction of the same magnitude as a rested muscle. By training intuitively you can still cause sufficient microtrauma to your muscles fibers to encourage growth, without continually draining your nervous system. Training to just before failure will still create gains.

Multiple Sets are Better for Strength and Hormone Responses

So you may be thinking may be I should cut back on my sets and adopt a HIT type training with 1 high intensity and not train to failure to maximize training recuperation. Heavy duty training dismisses the possibility of significant muscular growth arising from anything other than brief, infrequent, maximal exertions. In practice however, most successful bodybuilders develop their physiques doing almost exactly the opposite. One study examined IGF-I and IGFBP-3 over a 25 week with subjects performing either 1 set or 3 sets of resistance exercise. Both groups had a 20% increase IGF-I at week 13, but after week 13 the 3 set group had larger increases in strength that occurred with a drop in IGFBP-3 (decreased 20%). Additionally, the 3 sets group had an approximately 50% greater increase in strength compared to the 1 set group7.

Learning from Powerlifters...

Training to failure each set has been a bodybuilding creed for decades. In the Blood and Guts training video Dorian trains with enough intensity to kill a bull!! In the movie "Pumping Iron" there is a memorable scene where Ed Corney was doing squats and simply would not going to stop until he had reached complete failure. Finally Arnold helped Corney put the weights back up on the rack and Corney collapsed to the ground in exhaustion. All bodybuilders know that I order to increase muscle hypertrophy, you have to overload the muscle. Training to momentary muscular failure, the point in a set where no further movement is possible despite one's best efforts, represents the ultimate overload on muscle, however train to all-out muscular failure every workout can be self defeating and ultimately a prescription for failure. Training to failure each set may also deplete your body to the extent that it does not have sufficient reserves to repair the body and create a situation where super compensation (or an increase of myofibrils) can occur. Training to failure (and beyond using forced reps and negatives) may lead to overtraining, therefore using a minimum number of working sets, and allowing the body enough time between workouts for both full recovery and super compensation may lead to an enhanced anabolic drive. A possible learning strategy that bodybuilders can learn from is that of competitive powerlifters. At the national level, the mass of powerlifters is quite impressive yet they never train to failure. Powerlifter's workout intensity is quite low capered to the high intensity training protocols of bodybuilders. Despite their avoidance of training to failure, many powerlifters grow bigger and stronger despite their less than maximal efforts. It may be that training to failure each set puts too much of a stress on the body and recuperation and anabolic processes are reduced. This could have been the reason why the lifters who trained to failure had larger increases in cortisol after the training to failure routine in addition to lower IGF-I levels.

Stopping yourself before muscular failure is more psychological than anything for bodybuilders. For so long, it has been ingrained into our heads that training to failure is necessary for muscle growth. Training to failure is what separates the men from the boy's right? Training to failure each set may be just too much strain on the body. In fact, training just short of complete muscular exhaustion may away allows faster recuperation, depletes less of the systems resources, and causes less wear and tear on the body. It's interesting that most people who refer to themselves as "hard gainers" are the ones that train the hardest. These people can train to failure on every exercise for month after month and never show any sign of progress. So before you dismiss not training to failure as an excuse to not train hard or to downplay failure simply because of lack of courage or motivation, try this type of training for a few weeks...you might get bigger and stronger by training smarter not harder!

Key Points:

- Training to failure for a prolonged period of time can result in reduced serum IGF-I and testosterone responses.
- IGFBP-3 acts a storage pool for IGF-I, it preserves IGF-I functions. IGFBP-3 seems to be an accurate indicator of overtraining.
- Forced reps cause larger increases in GH than maximal reps, but also cause larger increases in cortisol and reduced maximal strength.
- Training just short of complete muscular exhaustion may away allows faster recuperation, depletes less of the systems resources, and causes less wear and tear on the body.
- IGF-I levels are heavily influenced by total calories and protein intake.