Letter to the Editor

RE: Mesocycle Progression in Hypertrophy: Volume Versus Intensity

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TO THE EDITOR:

We read with appreciation the article by Israetel et al. (14), "Mesocycle Progression in Hypertrophy: Volume versus Intensity," examining how to optimally progress across hypertrophy mesocycles. The authors propose that weekly progressions in the number of sets should be prioritized over progressions in percentage of 1-repetition maximum (% 1RM). The authors' recommendations are inferred from the dose-response relationship between volume and hypertrophy (26), and research demonstrating similar hypertrophy across a spectrum of loading ranges (24).

The authors rightly note that recent research establishes the volume-hypertrophy relationship as potentially inverted U-shaped (12); if too much volume is performed, the magnitude of hypertrophy is lessened (12). Therefore, a minimum effective volume exists; a dose (when all else is theoretically equal) produces the smallest measurable hypertrophy, as does an optimal level of volume; a dose producing the most robust hypertrophy, when all else is equal. Per the most recent meta-analytic data, on average, the minimum effective and optimal levels of volume, in the context of training lasting as long as most studies, may be <5 sets and 10+ sets/week per muscle group, respectively (26). Additionally, a practical limit on training volume exists: the point beyond which one is unable to recover baseline performance, coined by Israetel et al. as maximum recoverable volume (MRV) (14).

UNSUPPORTED APPLICATION OF VOLUME'S RELATIONSHIP WITH HYPERTROPHY

The authors mentioned that to their knowledge, no research has directly compared pure intensity to pure volume progressions. The authors state, "To guide our hypothesizing, we have to ask the question of 'over an average mesocycle of program length, what contributes more to hypertrophy; volume, or intensity?' On this matter, there is a growing body of evidence suggesting that there is a dose–response of volume and hypertrophy and, such a relationship has not been shown for relative intensity, while the effects of load are not as clear" (14). However, the dose-response relationship between volume and hypertrophy is based on comparisons of total volumes across a training duration, not week-to-week volume progression across a training duration. To our knowledge, no studies have matched total volume while comparing a group increasing weekly sets with a group that maintains a fixed number of sets week to week. Although load does not have a clear dose-response with hypertrophy (24), the existing data does not directly support the recommendation that set volume should be the primary training variable progressed across a mesocycle.

MISAPPLICATION OF PROGRESSIVE OVERLOAD PRINCIPLE

Implicit in this article is the assumption that progression should occur on a week-to-week basis, which may be a misapplication of the progressive overload principle. Although "overload" is commonly accepted as the action of surpassing a prior performance/stimulus, it is arguably best defined as imposing a stimulus sufficient for an adaptive response. Progressive overload could therefore be described as the observation of improved performance because of these adaptations.

The "overload threshold" is never precisely known, but given the lengthy time course of hypertrophy in well-trained individuals (2), it is likely determined by prior adaptations rather than acute prior stimuli (e.g., volume in the prior week). In other words, as adaptations occur, the required stimulus for overload increases, and a larger stimulus is needed to "keep pace" with this increased overload threshold. Overload can therefore be reactive in nature, rather than applied proactively. This can ensure that the stimulus does not fall below the overload threshold, nor grossly exceed the optimal volume for subsequent adaptations. In fact, in trained individuals, acute proactive progression may be unnecessary and overly aggressive. This point was illustrated in a 6 week study by Haun et al. (11), who increased weekly sets from 10 to 32 with significant changes in extracellular water-corrected lean body mass from PRE (prior to week 1) to MID (after week 3), but non significant changes from MID to POST (after week 6). Although the optimal time course for progression cannot be known, improved performance (when all else is equal) can serve not only to provide subsequent overload but also as evidence that current levels of volume have been "overloading" in nature.

PROGRESSING UP TO MAXIMUM RECOVERABLE VOLUME IS UNNECESSARY AND MAY BE SUBOPTIMAL

Israetel et al. define MRV as "The amount of volume at which consistent recovery of performance becomes impossible" (14). Later, the authors state "In general, higher volumes (to a point of inability to recover from them. i.e., MRV) result in more hypertrophy" (14). This definition of MRV seems equivalent to workload capacity, and depending on the time frame, would be determined by the repeated bout effect and muscle damage repair and/or metabolic recovery. To our knowledge, there is no evidence of, or theoretical reason to believe, that workload capacity (MRV) is related to optimal volume for hypertrophy. Conceptually, optimal volume would only be related to MRV if an individual's recuperative capacity (MRV) was sufficiently poor to prevent them from performing what would otherwise be optimal volume. Conversely, an individual could adapt to regularly performing and recovering from very high volumes but be in excess of what would be optimal for hypertrophy. Given the similarity in Israetel et al. definition of MRV and the established definition of overreaching (a temporary reduction in performance), we argue that MRV and optimal volume for hypertrophy may be disassociated. In a recent systematic review on resistance training and overreaching, 10 of 22 studies did not observe a reduction in performance despite the intent to induce overreaching (7). In studies where performance did decrease, weekly sets were far in excess of what has been observed to induce optimal rates of hypertrophy (7). This provides indirect evidence that optimal volume for hypertrophy and MRV are not necessarily related.

Higher volumes do not yield linear hypertrophy; rather, increases in volume yield diminishing rates of hypertrophy. As reported by Schoenfeld, 10+ weekly sets produced 36% more hypertrophy than <5 sets, such that a 100% (minimum) increase yielded a 36% increase in muscle size. As mentioned previously, the relationship between volume and hypertrophy may be inverted U-shaped (12). Although more volume produces more hypertrophy to a point, it is unclear when further increases in volume result in no additional increase or possible regression in hypertrophy. Although some evidence points to optimal volumes at ~30+ sets per muscle group per week (4,22,25), other evidence indicates peak magnitudes in hypertrophy at 6–18 sets, with no further increases at higher volumes (12,19). Most problematic is in some research where 14–28 sets produced no hypertrophy from baseline, compared with positive outcomes in groups performing 9–18 weekly sets per muscle group (1,9).

The relationship between volume and hypertrophy is likely heavily influenced by other training variables such as load, proximity to failure, frequency, exercise selection, technical execution, and rest periods. Additionally, individual hypertrophy is influenced by factors such as biological and training age, prior training adaptations, sex, and genetic differences (10).

LACK OF EVIDENCE THAT A DECREASE IN REPETITIONS AND INCREASE IN LOAD IS SUBOPTIMAL

The authors state "programs that drop repetitions from week to week as weights used go up rapidly (sets of 10 one week, 8 the next, 6 the next, and so on) are likely suboptimal for inducing muscle growth" (14). No data support that 6, 8, and 10RMs are decreasingly fatiguing or increasingly stimulative. All data supporting load as driving fatigue compares high-load sets near failure with lower-load sets that are not (5,6,13,28). The authors state repetitions in reserve (RIR) be considered the same for comparative purposes, which warrants assessing studies with the same number of sets, at similar RIRs, but different repetition zones. Indeed, 25–30RM was rated as higher exertion compared with 8–12RM (23), and sets to failure at 60 versus 90% 1RM were rated at higher effort and produced higher heart rates (21). Furthermore, Shimano observed higher rating of perceived exertion (RPE) at 60% of 1RM (8.8 ± 0.7) compared with both 80% of 1RM (7.4 ± 1.4) and 90% of 1RM (6.9 ± 2.5) during back squats; however, relevant to the present discussion, 80% loads on squats, curls, and bench press produced mean repetitions of 8.9–11.8, and 90% 3.9–6.5, yet RPE was not significantly different (27). Therefore, fatigue would likely be similar among sets in the 6–10 repetition range given in their example. Regarding stimulus, by their own logic and supported by their cited studies, sets in the 6–20 repetition range at a similar RIR produce similar hypertrophy. Thus, a program where the number of sets was fixed, repetition range decreased but did not fall below what is considered an equivalent stimulus for hypertrophy (~6 repetition set), although load increased to maintain RIR, cannot be said to be suboptimal.

As the authors state, "Adding weight on the bar while keeping repetitions the same or adding repetitions to each set but keeping load the same" are equivalent (14), so too is a decreasing rep scheme with similar RIR and sets in the "hypertrophy" rep range.

Research has also demonstrated that when number of sets are matched, linear periodization (load increasing while repetitions decrease) can lead to greater increases in fat-free mass compared with reverse linear periodization (load decreasing as repetitions increase) (20).

POTENTIAL IMPLICATIONS ON INJURY RISK

It is possible that weekly increases in sets could increase injury risk. As a preamble, injury rates in bodybuilding are quite low (15); thus, even with increased risk, absolute rates would likely remain low in comparison to types of lifting. Although we do not wish to promote alarmism, it is worth noting that authors of a recently published systematic review concluded that the acute-to-chronic workload ratio (ACWR) is associated with noncontact injuries in team sport and can be used as part of an injury monitoring program (8).

Acute-to-chronic workload ratio represents the relative difference in workload an athlete is adapted to, compared with what they are acutely performing. It is reasonably well established that sudden, large increases in volume compared with what athletes are thought to be adapted to can increase injury risk (3). However, there is no consensus for how ACWR should be calculated (rolling averages or weighted), what time frame "chronic workload" should be assessed (17,18), and there are issues with subjectivity in how data are used when calculating ACWRs (16). Because no studies on ACWR and injury in resistance training exist, it is unknown which metrics, over what time frame should be assessed. Despite these limitations, we advise against the authors' Figure 1 example of doubling set volume over a mesocycle, with concomitant load increases each week (14). This example more than doubles volume load over the course of a mesocycle, with a possible disproportionate increase in RPE relative to the volume performed.

ALTERNATIVE PROGRESSION MODEL

Although we disagree that decreases in repetitions and increases in load are suboptimal for hypertrophy, we agree load progression can/should occur to maintain a specific loading zone. This ensures the stimulus "keeps pace" with adaptations, while also providing insight when assessing the efficacy of existing volume over time.

One way to achieve these objectives is an autoregulated form of double progression. Each set is performed within a desired repetition range and to the same proximity to failure. As adaptations occur, repetitions progress within each set, until reaching the top of the repetition range. Load is then increased in the following session for that set.

We recommend beginning mesocycles with set-volume informed by prior training data, or in its absence, meta-analytic data (26) (~8–12 sets/muscle group). Volume can then be managed reactively, by assessing performance over time. This avoids potential issues from increasing volume too quickly or performing excessive amounts.

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