

Exercise Order in Resistance Training

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Introduction:

In the U.S, only thirty percent of the population participates in any form of resistance training (RT) (9). Why is this? Researchers speculate that this is related to participants lacking the proper knowledge to begin an RT program or fear of injury due to common myths and misconceptions on the topic (9). In regard to RT, the myriad of recommendations and various programs available can be overwhelming for novice exercisers to navigate. Similarly, even experienced athletes are challenged with multitudinous programming recommendations as they aim to find the best fit for their needs. Overall, RT has numerous benefits for any individual, from increasing muscle mass and strength to muscular endurance and power (2). Currently, RT studies and programs focus on different aspects of training. Including training programs that focus on the whole body versus muscle isolation to work specific areas to influence an increase in muscle size (hypertrophy), strength, or muscular endurance. With this in mind, the order of RT can be manipulated throughout the entirety of a program to achieve these results. But this leads to the question, how should the order of exercises be approached or potentially changed? Is it important to start RT with multi-joint exercises (MJ) or can single-joint (SJ) exercises be done instead? How does the manipulation of volume and intensity effect training outcomes? These questions have been a major point of debate for RT. As such, the purpose of this article is to unravel these mysteries through a look at the level/skill of the lifter, single joint exercises versus multi-joint, and the influence of intensity and volume. Changes to any one of these aspects influence hypertrophy, strength, or muscle endurance and how can this be implemented for program design.

Resistance Training Recommendations and Programming

Current recommendations for RT based on ACSM's guidelines indicate that when training or prescribing exercise for lifters, the primary focus should be on training each major muscle group (10). This is primarily achieved through the manipulation of volume and/or intensity depending on the individual's goals. For example, this strength training for 2-4 sets per muscle group for 8-12 repetitions at 60-80% of the individuals one repetition maximum (1RM), completed 2-3 times a week can be completed in various ordering of muscle groups (10). In all, with a known quantifiable range for repetitions, will the workout comprise of total body

exercises or will the training be split by muscle groups? That is left up to trainer to decide, specificity is a variable that is dependent on the individual and what it is they want to achieve, be that through strength adaptations or increasing muscle endurance. Inevitably, as the level of training for the weightlifter increases, so does the complexity of programming.

Advanced RT and sport specific training must strictly apply the rule of specificity to ensure that any progress or adaptations can occur. Recommendations for such training can differ greatly with volume of repetitions being anywhere from 1-12 with an emphasis on the lower range of 3-5 repetitions showing the greatest increases for strength **(1)**. Concurrently, with volume being so low, this indicates that intensity for this group ranges from 80-100% of the 1 RM. When compared to novice weightlifters, there is a clear-cut change in programming that can be defined by the principle of progressive overload. Now that the early adaptations of RT have been completed, to continue the maximal recruitment of muscle fibers and hypertrophy, alterations to training must be consistent, be that from changes to volume, intensity, or even order of the muscles exercised **(1)**.

Single-joint Versus Multi-joint

The simplest way to manipulate the order of RT is through the exercises chosen. While both single-joint and multi-joint exercises target the same muscle groups, multi-joint lifts have the added benefit of recruiting secondary muscle groups or antagonist muscles. For example, during the flat bench press movement, while the primary focus for the muscle groups is the pectoralis major, both the shoulders and elbows are incorporated in this multi-joint movement. The Chest fly movement is a single-joint movement for pectoralis muscle group due to only using the shoulder joint **(2)**. In terms of strength adaptations, literature has always suggested completing MJ exercises before moving on to SJ exercises for a single session workout **(12)**. Literature still supports this outcome for upper body tests. It was found that performing MJ exercises instead of SJ exercises had greater outcomes for strength gains **(12)**. Additionally, muscle hypertrophy adaptations aren't as clearly defined. It was reported that completing either SJ prior to MJ or MJ prior to SJ exercises produced similar results in total muscle mass gained **(6)**. Avelar and researchers (2019) concluded two main outcomes from their study related to exercise order. For general fitness and novice lifters, completing MJ exercises was the better choice of exercises **(12)**. And while the type of exercise is important such as completing a free weight squat as the primary exercise for lower body, the organization of the exercises by the

functional movement and the size of the targeted muscles are more important at the earlier stages of training such as completing any lower body exercises that targets the same muscle groups and movements **(3)**. This indicates while MJ provides greater increases in strength, this is only important if that is the desired outcome of the individual and their goals. As the goals become more specific for advanced lifters and sports athletes, a combination of the two to provide the necessary volume and frequency can be used.

Manipulation of Load

Another major variable for RT is load, which is the total amount of mass/weight lifted per repetition **(7)**. Load can be changed through volume, intensity, and frequency of training. As such, when designing exercise programs, it is a major determinant of how an individual wants to train. Generally, strength adaptations in RT intensity will be increased as volume is decreased. Contrarily, in endurance training, the intensity decreases as volume increases **(10)**. Overall, both of these are factors that play into the load of a program. Relevant literature supports this conclusion with high repetition and low weight exercises having similar outcomes to low repetition and high weight exercises in terms of overall strength/hypertrophy gains which was shown following a twelve-week program with two groups of men, one being high load and low repetition and low load and high repetition **(7)**. Along with that, the study went on to say that this was the case for low load and high repetition if an intermittent supplementation of heavy loads is used **(7)**. While they are similar, low repetition and greater weight did provide consistently higher improvements to an individual's 1RM. Indicating that to improve overall muscular strength, high load exercise must be completed at some point. It can be concluded that emphasizing intensity compared to volume in a trained population can provide an advantage in accelerating muscle growth and strength for short term cycles **(8)**. Why this occurs is speculated by Mangine and Researchers (2015) through an increased activation of more muscles fibers during exercise which stimulates a greater adaptation across a greater percentage of the muscle.

Parameters have been defined for the manipulation of load in terms of RT adaptations; however how does this influence program design? Again, it comes down to an individual's specific goals. For example, an individual looking to increase their 1RM, the use of high load programs that emphasize high intensity may be for the best **(11)**. But at the same time, if an individual is more concerned with muscular fitness for their health, the use of high load programming isn't necessary. High load can be substituted and mixed with low load programs that

focus on higher volume all with the goal of providing exercise programs that are not repetitious in nature.

Introduction of Concurrent Training

In the realm of exercise, programming and personal health are not one dimensional. While RT holds many benefits, it is not the be all end-all of exercises used to maintain an individual's health **(10)**. Aerobic fitness must also be considered and implemented as well. The issue with this is the amount of time needed to complete both RT and endurance training during a single workout session. This is considered concurrent training and is not optimal for training as it can have a detrimental effect on an individual's RT program **(5)**. Research has demonstrated that endurance training before RT can interfere with strength adaptations through impaired neuronal activity, glycogen storage, and interference of muscle hypertrophy **(4)**. To help negate some of these effects, aerobic training should take place after at least a 24hr period or vice versa depending once again on the individual's goal **(5)**. If aerobic conditioning is the primary objective, then strength training should come secondary after an adequate recovery period. If strength is the primary objective, then it is switched **(4)**. In all, concurrent training is not ideal if an individual is training for specific goals in strength gains. But if it is required, split workouts and at least 24hr periods between the two are needed. If the goal of the individual is solely based in healthy living and improvement to their physical fitness then training can be done during the same day that falls in line with their primary goals, be that increasing their running speed or improving their total muscle mass all while still monitoring appropriate recovery through rest days.

Conclusion

When it comes to RT, there are many variables that can be used to influence training adaptations. Variations to the order of RT, when designing a program, are the manipulation of load through changes to volume and intensity, the sequence used of MJ and SJ exercises, and concurrent training. As such, the main outcome when designing RT programs for individuals is the use of specificity. Each individual is unique in their own way and so is each of their responses to training. So, recommendations to consider are MJ exercises completed before SJ exercises provide greater increases in strength adaptations **(12)**. Individuals training to increase their 1RM will benefit most from high intensity and low volume training sessions **(11)**. RT with

endurance training will lead to limited strength adaptations compared to strength training alone but with the added benefit of increased cardiovascular endurance (4).

Apply it:

- When designing resistance training programs consider the individuals overall goals and level of previous training. Specificity of training becomes increasingly relevant as training progresses and indicates when manipulation of resistance training (RT) order may need to be implemented.
- Concurrent training with aerobic exercise is detrimental to overall adaptations for RT. If prescribed or desired, split workouts and a 24hr period for recovery is optimal.

Bridge the Gap:

Programing for resistance training can be manipulated through a number of variables such as manipulation of load through volume and intensity, use of MJ and SJ exercises such as a bench press and chest fly, and concurrent training. When designing a program for an individual the main outcome is dependent on their goals, so specificity becomes the primary determinant for this. The order of resistance training must be manipulated to achieve these results.

Summary:

The main outcome when designing RT programs for individuals is the use of specificity. Each individual is unique in their own way and so is each of their responses to training.

Pulled Text:

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Bio

Caleb Lafler, achieving B.S in Exercise Science at the University of New Mexico. Pursuing a future career in Occupational Therapy. His interests are in powerlifting training/programing and outdoor rock climbing.

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