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Commentary

Cluster Sets for Muscle Hypertrophy: A Short Review †

Salvador Vargas-Molina [1, 2, 3, *], Jorge L. Petro [3, 4], Diego A. Bonilla [3, 4, 5], Eneko Baz-Valle [6], Leandro Carbone [7], Roberto Cannataro [8], Javier Benítez-Porres [1]

1. Faculty of Medicine, University of Málaga, Spain; E-Mails: salvadorvargasmolina@gmail.com; benitez@uma.es
2. EADE-University of Wales Trinity Saint David, Málaga, Spain
3. Research Division, Dynamical Business & Science Society-DBSS International SAS, Bogotá 110311, Colombia; E-Mails: jlpetro@dbss.pro; dabonilla@dbss.pro
4. Research Group in Physical Activity, Sports and Health Sciences (GICAFS), Universidad de Córdoba, Montería, Colombia
5. Grupo de investigación Nutral, Facultad Ciencias de la Nutrición y los Alimentos, Universidad CES, Medellín 050021, Colombia
6. Department of Physical Education and Sport, University of the Basque Country UPV/EHU, Vitoria-Gasteis, Spain; E-Mail: ebaz001@ikasle.ehu.eus
7. Physical Activity and Sports, Faculty of Medical Science, University of Salvador, Buenos Aires, Argentina; E-Mail: leandrocarbone@gmail.com
8. Department of Pharmacy, Health and Nutritional Sciences, University of Calabria, 87036 Rende, Italy; E-Mail: r.cannataro@gmail.com

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* **Correspondence:** Salvador Vargas-Molina; E-Mail: salvadorvargasmolina@gmail.com

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Abstract

Cluster-set resistance training is focused on performance improvements of sports by increasing the repetition maximum, jump height, and efficiency in the sprint. In this commentary, we present relevant aspects to optimize the use of cluster training under the context of muscle hypertrophy. Therefore, we address intra-sets pauses, the number of repetitions per block, and strategies that benefit this methodology. During a cluster set resistance training program, not only the total number of repetitions could be higher, which means a superior total volume, but also a higher mechanical output might lead to potential benefits to muscle hypertrophy.

Keywords

Mechanical tension; intra-set; rest-pause; cluster-training; body building, body composition

1. Introduction

Traditional set (TS) schemes usually involve a specific number of repetitions, which can vary from one onwards, performed in a continuous motion fashion without any pause in between. Moreover, rest periods could be divided into inter-set, allocated between each set of repetitions and intra-set. Here, the goal is to establish short recovery periods interspersed between repetitions. It is common to see in the literature the terms cluster sets (CS), rest pause (RP), and drop sets (DS) refer to the same concept given that all these training methodologies have the same basic structure: a set of consecutive repetitions with a short resting period followed by more repetitions in the given set. In DS configurations, concentric failure is desired. Once it has been achieved, immediately afterward, the set goes on with a lower weight until muscular failure is reached. Usually, two-three weight reductions are used, ranging between 20–25% of the load, but some high-volume schemes might involve as many weight drops as possible (REF). In contrast, RP configurations maintain the weight while incorporating short intra-set rest periods in order to increase the volume at a given intensity, whereas, in CS, the number of repetitions, blocks, and intra-set resting periods were fixed previously (Figure 1). However, the standardization of the terminology and concepts used related to block training methods is needed [1].

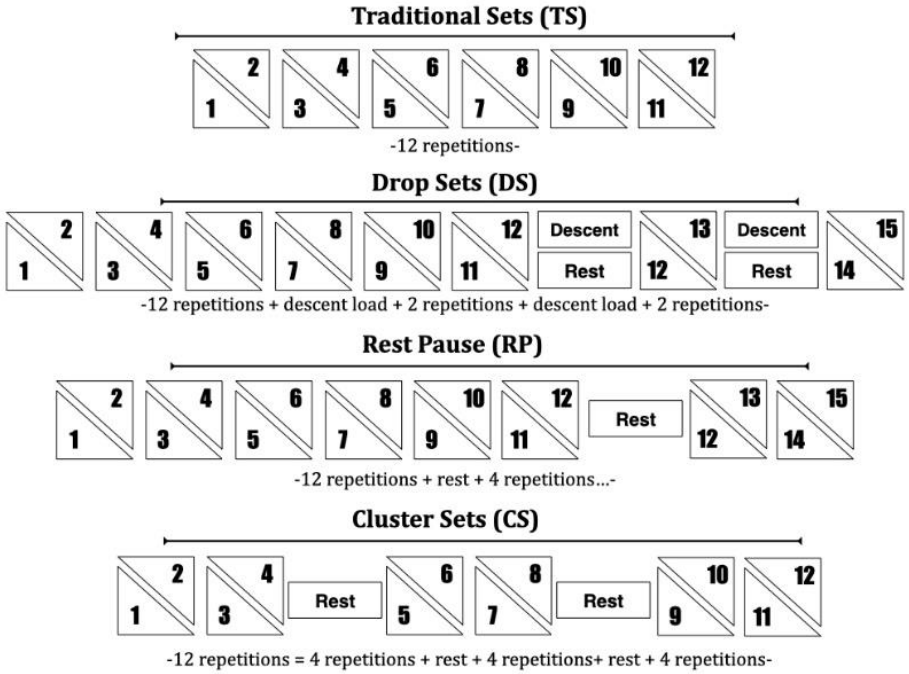

Figure 1 Cluster sets, rest pause, and drop sets.

The aim of the rest period is to allow phosphocreatine (PCr) resynthesis, re-establish intramuscular pH, enhance the clearance of cellular metabolic waste products, restore membrane potential to resting values, and increase blood flow reperfusion into the muscle and consequently increase oxygen transport to the tissues [2]. Previous work has shown that PCr resynthesis has a biphasic time course behavior (fast phase during the first 21–22 s and slow phase from 170 s and beyond) during rest [3]. CS takes advantage of the fast PCr recovery kinetics and allows either a higher mechanical output within the same training volume or a higher volume at the same mechanical output.

2. Cluster Sets and Sports Performance

Although this short comment is focused on the potential benefits that this methodology might have on body composition and muscle hypertrophy, it is essential to highlight that the original objective of these advanced training methods was to increase strength and power. Moreover, most research published on the topic reported either power or strength related outcomes such as barbell velocity, force, and lower body power [4], sprinting and jumping capacity [5–8], jumping peak velocity and height [6] and also, peak power and peak velocity [5, 9, 10]. In addition, muscular endurance variables such as time under tension (TUT) and muscle fatigue have also been investigated [11]. It has been well established the potential benefits of CS training methods are increased performance-related measures such as one repetition maximum (1-RM), jumping, and sprinting capacity.

3. Cluster Sets and Muscle Hypertrophy

As has been mentioned, even though CS protocols are more oriented to increase performance and strength levels, they may be a useful tool to increase total volume and thus increase mechanical

tension, which has been previously proposed as the main training stimuli behind muscle hypertrophy [12]. While high mechanical tension is usually related only to high training loads, it can be achieved with a wider intensity range (~60% and + 60% of 1-RM), as long as the set has reached or is close to reaching muscular failure [13] and the load is not dropped below 30% RM [14].

Previous investigations [15] suggested that using high loads (3-RM) requires a higher number of sets to match the effects of moderate loads (10-RM), which can be seen as a disadvantage. However, the incorporation of a CS protocol may be the key to overcoming this issue without the need to reach muscular failure and significantly increasing training volume. Furthermore, the effects of different traditional sets and CS protocols on lactate concentration and velocity loss have been reported in the set as markers of metabolic stress and performance, respectively [16]. These results have shown that 5RM produced a similar velocity loss compared with CS but with an increased blood lactate concentration.

The hypertrophic stimulus of a given set scheme between 6 to 20 or more repetitions is independent of the load as long as the muscular failure is reached [17]. However, if a CS method is applied in 3–5 RM blocks, with a total of 3–4 blocks, and intra-set rest periods are between 20–30 s, TM would be high at loads approximately ~90% of 1 RM with a higher total volume.

Moreover, Oliver et al. [18] showed lesser velocity loss, higher force, and an increased total volume in CS protocols compared with TS sets. This could be related to a greater mechanical tension. In addition, the investigation conducted by Iglesias-Soler et al. [19] compared the maximum number of repetitions between two protocols; the TS group performed three sets till failure with a 4 RM load with a 3 min rest in between sets. In contrast, the CS group followed the same protocol but with a 36-s intra-set rest period after each repetition. The total number of repetitions was more significant in the CS group; thus, a superior total volume was achieved. Additionally, higher mechanical performance was generated, showing a potential benefit to generate hypertrophy.

On the other hand, our team investigated three CS protocols: a) 3 RM + 3 RM + 3 RM + 3 RM with 20 s of intra-set pause; b) 3 RM + 3 RM + 3 RM + 3 RM with 40 s of intra-set pause, and c) 6 RM + 6 RM with 20 s of intra-set pause [20]. Our results indicated an increase in fat-free mass evaluated by DXA in all protocols, although the group that worked 3 RM with 20 s of rest obtained better results. In the same line, Gonzalez-Hernández et al. [16] showed that intra-set resting periods in between 15–30 s might be better from a hypertrophy point of view, given that a similar mechanical output could be obtained compared with more extended resting periods but with more emphasis on metabolic stress that could enhance the muscle growth stimuli. Additionally, we report that the application of creatine monohydrate in 3 RM protocols with 20 pauses would notably increase the fat-free mass and strength levels evaluated by MR [21].

4. Practical Applications

Even though more research is needed, some practical recommendations for applying CS methodology during a hypertrophy training program are depicted in Figure 2.

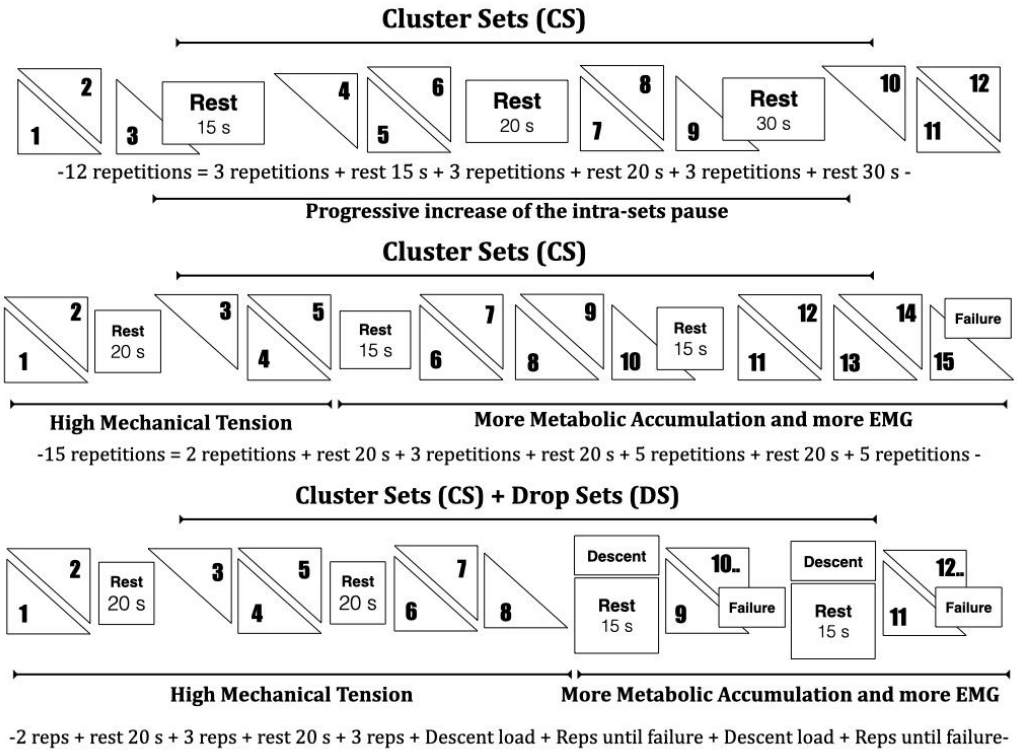

Figure 2 Examples of cluster set configuration.

A. The blocks should be organized between 3–5 RM.

B. Intra-set resting periods should oscillate between 10–20 s for the upper body or isolated movements and between 15–30 s for the lower body or compound movements.

C. Longer resting periods may be incorporated as a session progresses to avoid losses in either total volume or concentric phase movement velocity.

D. The use of mixed blocks, where the initial ones have a more mechanical tension orientation and the last ones with emphasis on metabolic stress with longer TUT. Even incorporating DS may be a potential way of taking advantage of different cellular mechanisms behind muscular hypertrophy and optimizing the training benefits.

E. The addition of creatine monohydrate seems to be an advantageous strategy for optimizing the benefits of CS protocols [21].

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Author Contributions

S.V. conceptualization and writing—original draft preparation. L.C. and D.A.B. translated the document. J.L.P., J.B.P., E.B., R.C. and D.A.B. review and editing. All authors read and approved the final manuscript.

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Competing Interests

D.A.B. serves as science product manager for MTX Corporation®, a company that produces, distributes, sells, and does research on dietary supplements (including creatine) in Europe, has acted as a scientific consultant for MET-Rx and Healthy Sports in Colombia, and has received honoraria for speaking about creatine at international conferences. Additionally, he serves as affiliate member of the "Creatine in Health" scientific advisory board for Creapure® - Alzchem Group AG.

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