INFLUENCE OF UPPER-BODY EXERCISE ORDER ON REPETITION PERFORMANCE AND RATINGS OF PERCEIVED EXERTION DURING A SUPER-SET RESISTANCE TRAINING SESSION

Hamid Arazi, Kazem Sotoudeh, Manije Mansour Sadeghi, Seyed Mahdi Mohammadi and Tahmineh Saeedi

Department of Exercise Physiology, Faculty of Sport Sciences, University of Guilan, Rasht, Iran

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Abstract

The purpose of this study was to examine acute Influence of upper-body exercise order on repetition performance and ratings of perceived exertion during a super-set resistance training bout. Twelve resistance-trained men were submitted to a super-set method by using two different exercise orders: bench press + lat pull down (BL) or lat pull down + bench press (LB)for each session. Training volume was significantly upper for the first sets compared with the second and third sets for both BL and LB order. Additionally, in the second and third sets of LB, training volume was upper than in the second and third sets of BL order. Regarding the total training volume, the values were lower in the BL order compared with the LB (P = 0.02). Conversely, (ratings of perceived exertion) was higher in the BL order compared with LB order (P = 0.04). Results revealed a superior moderate effect size in set 2 and 3, and total training volume for the LB super-set order compared with the BL order.

Key words:*exercise order, super-set, ratings of perceived exertion*

Introduction

The super-set is a widely used resistance training method consisting of exercises for agonist and antagonist muscles with limited or no rest interval between them for example, leg extension followed by leg curl. Muscle strength has an important influence on functional abilities, such as walking, stair climbing, and daily activities, as well as positive association with sports performance, longevity, and quality of life (Balsamo et al., 2012).

When prescribed appropriately with other key prescriptive variables (i.e. load, volume, repetition velocity, failure versus or non-failure sets, rest interval between sets and exercises), the exercise order can influence the efficiency, safety and ultimate effectiveness of an resistance training programmed (Simao et al., 2012). Current guidelines for resistance-exercise program design recommend that large muscle group exercises generally be performed first in a training session This exercise order recommendation has been supported by studies that found greater strength gains (Dias et al., 2010; Simao et al., 2010; Spineti et al., 2010) and hypertrophy (Simao et al., 2010; Spineti et al., 2010) in muscles that were trained at the beginning, rather than at the end, of a session during a long-term training program. Although previous studies have tested the super-set method as an exercise protocol to evaluate torque and power, no study has analyzed the effects of altering muscle-use order during super-sets for the upper limbs with typical isoinertial resistance training machines. Furthermore, related findings have been equivocal regarding exercise sequence and training volume.

For example, Sotoudeh et al found that total training volume is superior when training is initiated with large muscle groups followed by small muscle groups. However, other studies reported either no differences in training volume, regardless of the exercise order, when using the pre- exhaustion method or found that a higher volume of training could be performed when small muscle groups were used first. This reinforces the idea that exercise order in super-set method will affect training volume. Therefore, the purpose of this study was to examine acute Influence of upper-body exercise order on repetition performance and ratings of perceived exertion in response to a super-set resistance training session. The initial hypothesis was that in the exercise order lat pull down + bench press (LB) the total training volume would be higher and the ratings of perceived exertion (RPE) lower than the inverse order bench press + lat pull down (BL).

Methods

Twelve men aged 23.0 ± 4.3 years, height 175.8 ± 6.75 cm, body mass 77.8 ± 13.27 kg, body fat 12.0% ± 4.7%, participated in the study. Subjects had a minimum 6 months of previous experience with resistance training and trained 2–4 times per week using loads of 6–15 RM in sessions lasting up to 45–60 minutes. Twelve trained men participated in this study and visited the laboratory on five occasions. The subjects participated in a familiarization session as well as an80% one-repetition maximum (80%1RM) test on two different days separated by 48–72 hours to determine test re-test reliability. The same individuals were randomly submitted to a super-set method using two different exercise orders: BL or LB separated by 48–72 hours.

In the super-set method used in the present study, two exercises (agonist and antagonist) were executed with no rest interval between them. The dependent variables were the total training volume and the RPE. The independent variables were the two different exercise orders: BL and LB. According to the American College of Sports Medicine, therefore, the individuals were considered "trained (American College of Sports Medicine)." Exclusion criteria included: use of ergogenic supplements, steroid hormones, medications, and the presence of any type of cardiopulmonary disease or orthopedic limitation. Information regarding the benefits, risks, and nature of the study were provided. The subjects were advised to refrain from ingesting caffeine and alcohol for 24 hours before all tests, avoid any strenuous exercise in the 48-hours before the experimental sessions, and to maintain their normal daily diet during the study, according to the authors' previous study (Tibana, Prestes, da Cunha, Martins, De Santana, Balsamo). A familiarization session was carefully performed to allow for correct execution of the bench press and lat-pull down exercise technique. After 48–72 hours, the 80%1RM test was performed on two different days separated by 48–72 hours to guarantee optimal test retest reliability (Simao et al 2005). Before the initiation of the 80%1RMtest, a warm-up of two sets with submaximal loads for each exercise was allowed. After a rest interval of 2–4 minutes, individuals performed the first attempt and the load was increased until the determination of the 80%1RM.Two days after the80%1RM tests, the super-set training sessions were randomly performed with 48–72 h of rest interval between them: the BL super-set session (=bench press + lat pull down order) and the LB session (=lat pull down +bench press order). Before initiation of the super-set sessions, a warm-up of two sets of twelve repetitions at 40% of 80%1RM was allowed with a 90-second rest interval after them. Subjects performed three sets until voluntary concentric failure with 80%1RM loads and a rest interval of 90 seconds between sets. RPE was verified with the OMNI scale designed for resistance training immediately after each set in both exercise orders. The calculation of the total training volume for each exercise order was made by using the following equation: training volume 1 + training volume 2 + training volume 3. The training volume was calculated as: number of repetitions × load. The fatigue index, commonly defined as the drop in strength and power during a training session, was estimated for each exercise in both orders using the formula proposed by Diplaet al : FI = (third set/first set) × 100; where a higher percentage value (%) indicates a superior fatigue resistance.

Statistical analysis

Reliability of the 80%1RM tests was accessed by the intraclass correlation test and the values were 0.91 and 0.93 for the bench press and lat pull down, respectively. All variables presented a normal distribution and homoscedasticity.

The comparison between both super-set exercise orders (BL and LB) in each set was accessed by the two entries analysis of variance test(orders × sets). The Bonferroni post hoc test was applied where indicated by an analysis of variance. To verify the differences in the total training volume and RPE between BL and LB exercise orders, the unpaired Student's t-test and Wilcoxon test were used, respectively. In all calculations, the alpha level was set at $P \leq 0.05$. SPSS for Windows (v 16.0; SPSS) was used for all analyses.

Results and discussion

Table 1 presents the values of training volume performed in each set and the total training volume for all three sets for both exercise orders. Training volume was significantly upper for the first sets compared with the second and third sets for both BL and LB order. Additionally, in the second and third sets of LB, training volume was upper than in the second and third sets of BL order. Regarding the total training volume, the values were lower in the BL order compared with the LB ($P = 0.02$) (Table 1 and Figure 1). Conversely, RPE was higher in the BL order compared with LB order ($P = 0.04$) (Figure 2). Table 2 presents effect sizes for the three sets and for the total training volume. Results revealed a superior moderate effect size in set 2 and 3, and total training volume for the LBsuper-set order compared with the BL order.

Table 1 Total volume completed in each set and fatigue index for both super-set exercise orders

Order	Set1	Set2	Set3	Fatigue index%
B	2160.73±300	1445.50±121	1085.46±150	50.2357
BL	1980.50±210	1160.40±100	778.48±130	39.3072

/LB, (lat pull down + bench press) super-set exercise order; BL, (bench press + lat pull down) super-set exercise order./
Values are means ± standard deviation of the mean. *Statistically significant difference from set 1; statistically significant different from set 2 ($P \leq 0.05$).

The main findings of the present study revealed that when a super-set method was initiated with the LB order (lat pull down + bench press) an increased total training volume could be achieved with a lower RPE compared with the BL order (bench press + lat pull down).Alternatively, the results of the present study revealed that the super-set method was more effective for the total training volume by using the pre-activation of the lat pull down compared with the order that was initiated with the bench press. In this sense, adding to the benefits of the super-set method on energy expenditure and time optimization in a resistance training session, this method can be effective in increasing total training volume when lat pull down precedes bench press. Another interesting result was that the RPE was lower in the lat pull down + bench press order. The use of the bench press first will exacerbate the RPE in a super-set compared with the inversed order.

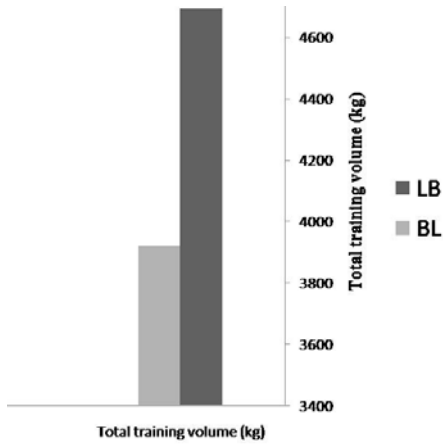

Figure 1 Total training volume for the LB = lat pull down + bench press super-set Exercise order and BL = bench press + lat pull down super-set exercise order.
/BL, (bench press) + (lat pull down) super-set exercise order; LB (lat pull down) + (bench press) super-set Exercise order/. Differencebetween BL and LB exercise order ($P \leq 0.05$). Values are Means ± standard deviation of the mean.

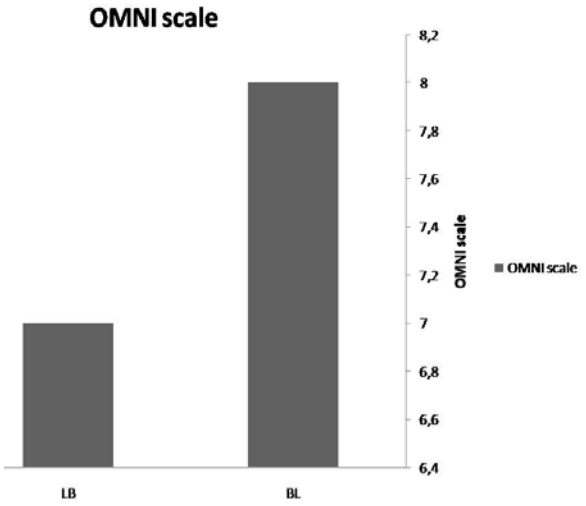

Figure 2 ratings of perceived exertion determined by the OMNI scale for the LB = lat pull down + bench press super-set exercise order and BL = bench press + lat pull down Superset exercise order.
/LB, (lat pull down) + (bench press) super-set exercise order; BL, (bench press) + (lat pull down) super-set Exercise order./ Difference between LB and BL exercise order ($P \leq 0.05$). Values are median.

It has been shown that the RPE can change with different resistance training volume. The interchange between agonist and antagonist muscles possible when using a super-set method with conventional resistance training equipment is a promising area of research for investigators and resistance training professionals. Future studies using the super-set method should be carried out with acute and chronic designs and different exercise orders in different muscle groups and individuals, analyzing muscle hypertrophy, strength, and hormonal response, and with the use of electromyography.

Conclusion

Our results indicate that when a super-set method was initiated with the LB order (lat pull down + bench press) an increased total training volume could be achieved with a lower RPE compared with the BL order (bench press + lat pull down).

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UTJECAJ PORETKA VJEŽBE GORNJEG DIJELA TIJELA NA UČINAK PONAVLJANJA I OCJENE PERCIPIRANOG NAPORA TIJEKOM SESIJE NAD-SKUPA TRENINGA OTPORA

Sažetak

Cilj ovog istraživanja je bio ispitati akutan utjecaj poretka vježbe gornjeg dijela tijela na učinak ponavljanja i ocjene percipiranog napora tijekom nadskupa treninga otpora. Dvanaest muškaraca obučenih na otpornost je bilo podloženo metodi nadskupa korištenjem dvaju različitih poredaka vježbe: bench press + lat pull down (BL) ili lat pull down + bench press (LB) za svaku sesiju. Volumen treninga je bio značajno viši u prvim setovima u usporedbi s drugim i trećim za BL i LB poredak. Dodatno, u drugom i trećem LB setu, volumen treninga je bio viši nego u drugom i trećem setu BL poretka. U pogledu na ukupan volumen treninga, vrijednosti su bile niže u BL poretku u usporedbi sa LB poretkom (P = 0.02). Obrnuto, (ocjene percipiranog napora), bio je viši u BL poretku u usporedbi sa LB poretkom (P = 0.04). Rezultati su otkrili superiornu umjerenu veličinu učinka u setovima 2 i 3 i ukupan volumen treninga za LB poredak nadskupa u usporedbi sa BL poretkom.

Ključne riječi*: poredak vježbe, nadskup, ocjene percipiranog napora*

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Correspondence to:
Hamid Arazi, PhD
University of Gullan
Faculty of Sport Sciences
P.O. BOX: 41635-1438 Rasht, Iran
E-mail: hamidarazi@yahoo.com