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Articolo di ricerca (originale)

Journal of Strength and Conditioning Research, 2006, 20(4), 819–823

RIVISTA

RELATIONSHIP BETWEEN THE NUMBER OF REPETITIONS AND SELECTED PERCENTAGES OF ONE REPETITION MAXIMUM IN FREE WEIGHT EXERCISES IN TRAINED AND UNTRAINED MEN

TITOLO

TOMOKO SHIMANO,[1] WILLIAM J. KRAEMER,[1] BARRY A. SPIERING,[1] JEFF S. VOLEK,[1] DISA L. HATFIELD,[1] RICARDO SILVESTRE,[1] JAKOB L. VINGREN,[1] MAREN S. FRAGALA,[1] CARL M. MARESH,[1] STEVEN J. FLECK,[2] ROBERT U. NEWTON,[3] LUUK P.B. SPREUWENBERG,[4] AND KELIO HÄKKINEN[5]

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Articolo di ricerca (originale)

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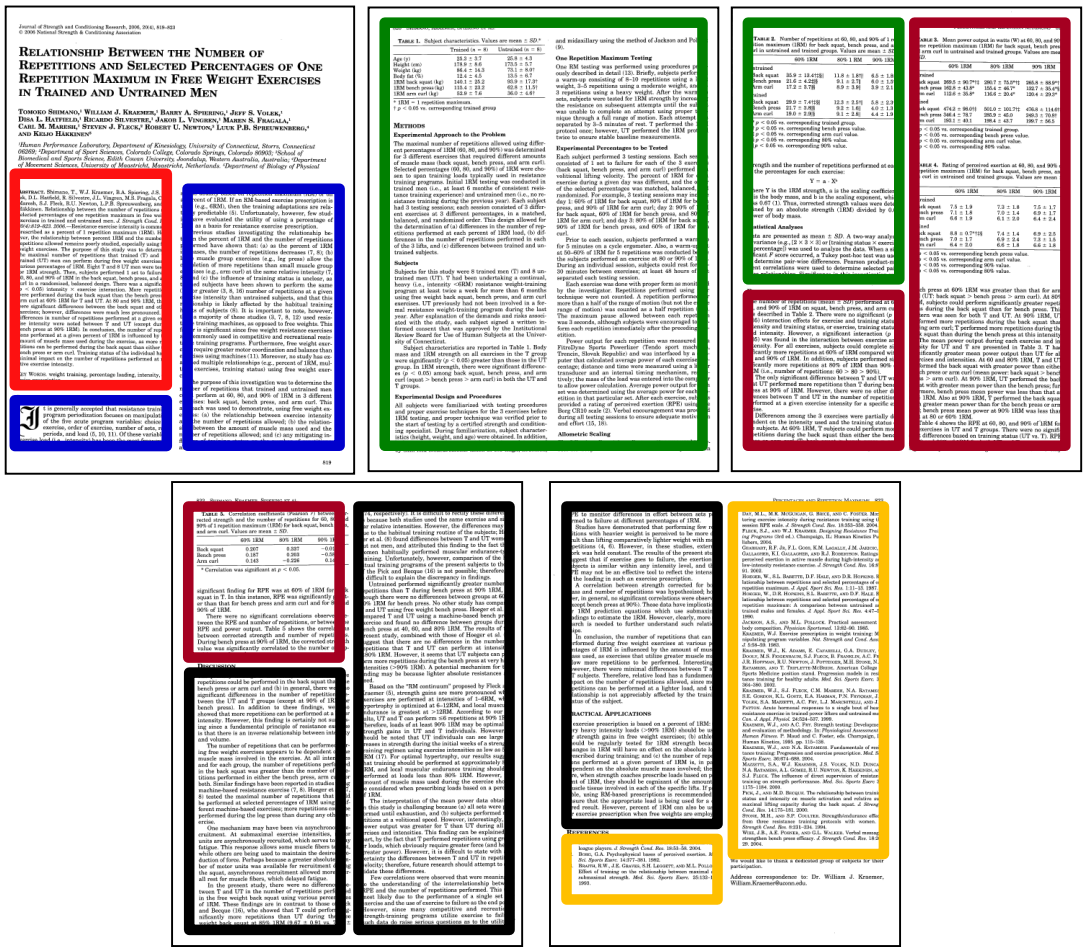

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ABSTRACT

Contiene un dettagliato riassunto dell'articolo

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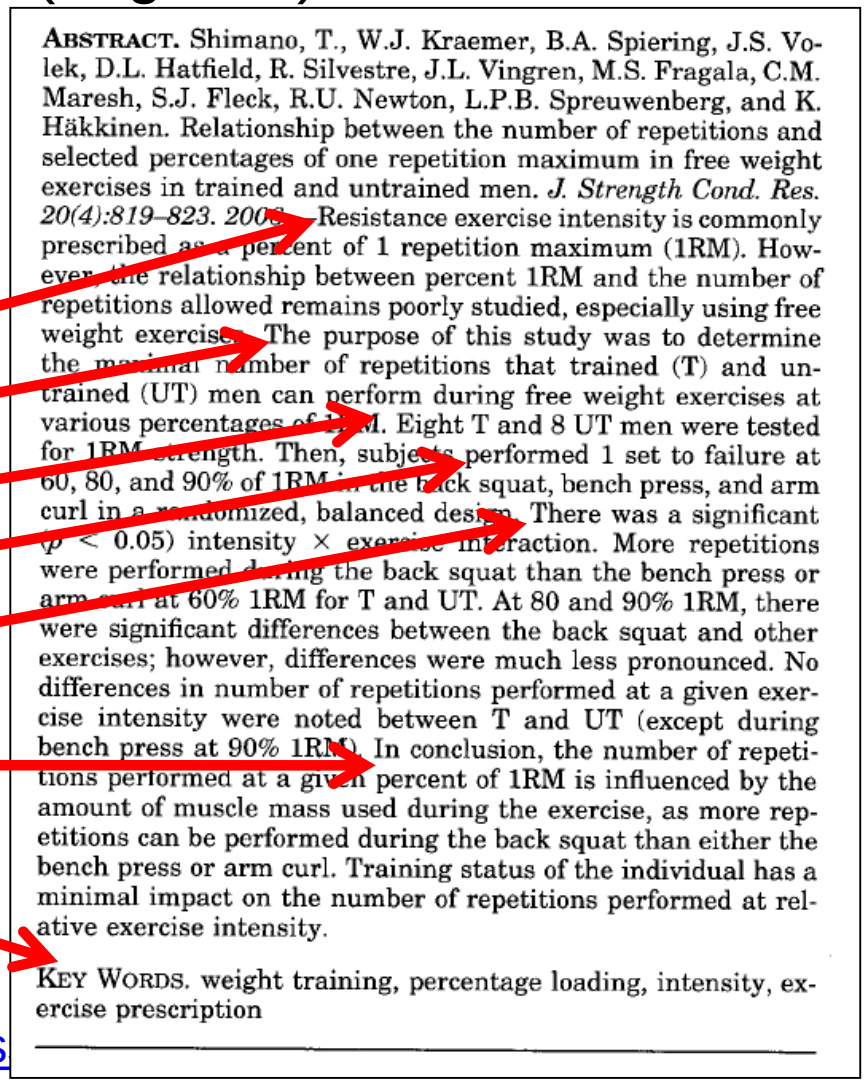

Abstract. Shimano, T., W.J. Kraemer, B.A. Spiering, J.S. Volek, D.L. Hatfield, R. Silvestre, J.L. Vingren, M.S. Fragala, C.M. Maresh, S.J. Fleck, R.U. Newton, L.P.B. Spreuwenberg, and K. Häkkinen. Relationship between the number of repetitions and selected percentages of one repetition maximum in free weight exercises in trained and untrained men. *J. Strength Cond. Res. 20(4):819–823. 200*. Resistance exercise intensity is commonly prescribed as a percent of 1 repetition maximum (1RM). However, the relationship between percent 1RM and the number of repetitions allowed remains poorly studied, especially using free weight exercise. The purpose of this study was to determine the maximal number of repetitions that trained (T) and untrained (UT) men can perform during free weight exercises at various percentages of 1RM. Eight T and 8 UT men were tested for 1RM strength. Then, subjects performed 1 set to failure at 60, 80, and 90% of 1RM in the back squat, bench press, and arm curl in a randomized, balanced design. There was a significant ($p < 0.05$) intensity × exercise interaction. More repetitions were performed during the back squat than the bench press or arm curl at 60% 1RM for T and UT. At 80 and 90% 1RM, there were significant differences between the back squat and other exercises; however, differences were much less pronounced. No differences in number of repetitions performed at a given exercise intensity were noted between T and UT (except during bench press at 90% 1RM). In conclusion, the number of repetitions performed at a given percent of 1RM is influenced by the amount of muscle mass used during the exercise, as more repetitions can be performed during the back squat than either the bench press or arm curl. Training status of the individual has a minimal impact on the number of repetitions performed at relative exercise intensity.

Key Words. weight training, percentage loading, intensity, exercise prescription

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INTRODUZIONE

Contiene tutti i fondamenti teorici, basati su studi pregressi, che giustificano la motivazione dello scopo dello studio. Nell'ultima parte contiene anche lo scopo del lavoro di ricerca. In questa sezione è fondamentale lo studio della bibliografia presente al momento dello studio

Journal of Strength and Conditioning Research, 2006, 20(4), 819–823
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RELATIONSHIP BETWEEN THE NUMBER OF REPETITIONS AND SELECTED PERCENTAGES OF ONE REPETITION MAXIMUM IN FREE WEIGHT EXERCISES IN TRAINED AND UNTRAINED MEN

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ABSTRACT. Shimano, T., W.J. Kraemer, B.A. Spiering, J.S. Volek, D.L. Hatfield, R. Silvestre, J.L. Vingren, M.S. Fragala, C.M. Maresh, S.J. Fleck, R.U. Newton, L.P.B. Spreuwenberg, and K. Häkkinen. Relationship between the number of repetitions and selected percentages of one repetition maximum in free weight exercises in trained and untrained men. *J. Strength Cond. Res. 20(4):819–823. 2006.*—Resistance exercise intensity is commonly prescribed as a percent of 1 repetition maximum (1RM). However, the relationship between percent 1RM and the number of repetitions allowed remains poorly studied, especially using free weight exercises. The purpose of this study was to determine the maximal number of repetitions that trained (T) and untrained (UT) men can perform during free weight exercises at various percentages of 1RM. Eight T and 8 UT men were tested for 1RM strength. Then, subjects performed 1 set to failure at 60, 80, and 90% of 1RM in the back squat, bench press, and arm curl in a randomized, balanced design. There was a significant ($p < 0.05$) intensity × exercise interaction. More repetitions were performed during the back squat than the bench press or arm curl at 60% 1RM for T and UT. At 80 and 90% 1RM, there were significant differences between the back squat and other exercises; however, differences were much less pronounced. No differences in number of repetitions performed at a given exercise intensity were noted between T and UT (except during bench press at 90% 1RM). In conclusion, the number of repetitions performed at a given percent of 1RM is influenced by the amount of muscle mass used during the exercise, as more repetitions can be performed during the back squat than either the bench press or arm curl. Training status of the individual has a minimal impact on the number of repetitions performed at relative exercise intensity.

KEY WORDS. weight training, percentage loading, intensity, exercise prescription

percent of 1RM. If an RM-based exercise prescription is
ed (e.g., 6RM), then the training adaptations are rela-
ely predictable (5). Unfortunately, however, few stud-
have evaluated the utility of using a percentage of
M as a basis for resistance exercise prescription.
Previous studies investigating the relationship be-
een the percent of 1RM and the number of repetitions
rformed have shown that: (a) as the percent of 1RM
reases, the number of repetitions decreases (7, 8); (b)
ge muscle group exercises (e.g., leg press) allow the
mpletion of more repetitions than small muscle group
ercises (e.g., arm curl) at the same relative intensity (7,
and (c) the influence of training status is unclear, as
ined subjects have been shown to perform the same
) or greater (3, 8, 16) number of repetitions at a given
ercise intensity than untrained subjects, and that this
ationship is likely affected by the habitual training
bits of subjects (8). It is important to note, however,
t a majority of these studies (3, 7, 8, 12) used resis-
ce training machines, as opposed to free weights. This
tor is significant since free weight resistance exercises
commonly used in competitive and recreational resis-
ce training programs. Furthermore, free weight exer-
es require greater motor coordination and balance than
ercises using machines (11). Moreover, no study has ex-
ined multiple relationships (e.g., percent of 1RM, mul-
e exercises, training status) using free weight exer-
e.
The purpose of this investigation was to determine the
mber of repetitions that trained and untrained men
ld perform at 60, 80, and 90% of 1RM in 3 different
ercises: back squat, bench press, and arm curl. This
proach was used to demonstrate, using free weight ex-
ises: (a) the relationship between exercise intensity
d the number of repetitions allowed; (b) the relation-
p between the amount of muscle mass used and the
mber of repetitions allowed; and (c) any mitigating in-
ence of training status on the number of repetitions
wed.

It is generally accepted that resistance trainin
program periodization focuses on manipulatio
of the five acute program variables: choice
exercise, order of exercise, number of sets, re
periods, and load (5, 10, 11). Of these variable
exercise load (i.e., intensity) has been the most frequent
studied (14). The prescription of resistance exercise inte

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Articolo di ricerca (originale)

METODI

È una spiegazione dettagliata delle procedure scelte, con lo scopo di rendere "trasparente" la ricerca nel caso altri studiosi vogliano confutarla ripetendo gli stessi step operativi

METHODS

Experimental Approach to the Problem

The maximal number of repetitions allowed using different percentages of 1RM (60, 80, and 90%) was determined for 3 different exercises that required different amounts of muscle mass (back squat, bench press, and arm curl). Selected percentages (60, 80, and 90%) of 1RM were chosen to span training loads typically used in resistance training programs. Initial 1RM testing was conducted in trained men (i.e., at least 6 months of consistent resistance training experience) and untrained men (i.e., no resistance training during the previous year). Each subject had 3 testing sessions; each session consisted of 3 different exercises at 3 different percentages, in a matched, balanced, and randomized order. This design allowed for the determination of (a) differences in the number of repetitions performed at each percent of 1RM load, (b) differences in the number of repetitions performed in each of the 3 lifts, and (c) differences between trained and untrained subjects.

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Articolo di ricerca (originale)

METODI

I soggetti partecipanti vengono descritti a fondo: numero, sesso, stili di vita, suddivisione nei diversi gruppi di studio ed eventuali differenze iniziali tra i gruppi

Subjects

Subjects for this study were 8 trained men (T) and 8 untrained men (UT). T had been undertaking a continual, heavy (i.e., intensity <6RM) resistance weight-training program at least twice a week for more than 6 months using free weight back squat, bench press, and arm curl exercises. UT previously had not been involved in a formal resistance weight-training program during the last year. After explanation of the demands and risks associated with the study, each subject signed a written informed consent that was approved by the Institutional Review Board for Use of Human Subjects at the University of Connecticut.

Subject characteristics are reported in Table 1. Body mass and 1RM strength on all exercises in the T group were significantly ($p < 0.05$) greater than those in the UT group. In 1RM strength, there were significant differences ($p < 0.05$) among back squat, bench press, and arm curl (squat > bench press > arm curl) in both the UT and T groups.

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Articolo di ricerca (originale)

METODI

La descrizione dei soggetti prende in considerazione anche i parametri antropometrici e l'età. Quello che può essere valido ed evidente per un campione di soggetti può non esserlo per altri

TABLE 1. Subject characteristics. Values are mean ± *SD*.*

	Trained (n = 8)	Untrained (n = 8)
Age (y)	25.3 ± 3.7	25.8 ± 4.3
Height (cm)	178.9 ± 8.6	173.5 ± 5.7
Weight (kg)	86.4 ± 14.3	73.1 ± 8.0†
Body fat (%)	12.4 ± 4.5	13.5 ± 6.7
1RM back squat (kg)	140.1 ± 25.2	93.9 ± 17.3†
1RM bench press (kg)	115.4 ± 23.2	62.8 ± 11.5†
1RM arm curl (kg)	52.9 ± 7.6	36.0 ± 4.6†

* 1RM = 1 repetition maximum.
† $p < 0.05$ vs. corresponding trained group

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Articolo di ricerca (originale)

METODI

Vengono infine descritte le procedure di analisi statistica per la valutazione di eventuali differenze o correlazioni tra i dati rilevati

Statistical Analyses

Data are presented as mean ± *SD*. A two-way analysis of variance (e.g., [2 × 3 × 3] or [training status × exercise × percentage]) was used to analyze the data. When a significant *F* score occurred, a Tukey post-hoc test was used to determine pair-wise differences. Pearson product-moment correlations were used to determine selected pair-wise relationships. Significance in this investigation was defined as $P \leq 0.05$.

In questo studio:

- Medie
- Deviazioni Standard
- Test per differenze significative
- Correlazioni

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BREVISSIMA NOTA SUI TERMINI STATISTICI PIÙ UTILIZZATI NEGLI ARTICOLI

- **Media**: riassume con un solo numero un insieme di dati
- **Deviazioni Standard**: indica la dispersione dei dati intorno al valore atteso (in questo caso la media)
- **Differenza significativa**: esistono diversi test statistici che valutano quanto la differenza tra due campioni (pre-post) possa essere di natura casuale o no. Quando il test statistico adottato individua che la differenza tra due campioni non è casuale allora si usa dire che la differenza è significativa. Si esprime con un valore numerico inferiore a 0,05: ovvero la differenza tra i due campioni è casuale solo al massimo per il 5%, per il 95% sarà data da un intervento che l'operatore ha messo in atto (es: il metodo di allenamento testato)
- **Correlazioni**: esistono di diversa natura matematica, ma tutte testano la possibilità che un evento possa dipendere dal verificarsi di un altro evento indipendente (es: forza a terra – altezza di salto)

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Articolo di ricerca (originale)

RISULTATI

Contengono gli output delle analisi statistiche evidenziano quali parametri differiscono tra loro, come e in che misura, se significativamente o no.
Si valuta se le procedure utilizzate supportano le ipotesi di partenza o no

TABLE 2. Number of repetitions at 60, 80, and 90% of 1 repetition maximum (1RM) for back squat, bench press, and arm curl in untrained and trained groups. Values are mean ± *SD*.

	60% 1RM	80% 1 RM	90% 1RM
Untrained			
Back squat	35.9 ± 13.4†‡§‖	11.8 ± 1.8†‖	6.5 ± 1.8‡
Bench press	21.6 ± 4.2‡‖§	9.1 ± 2.7‖	6.0 ± 1.5*
Arm curl	17.2 ± 3.7‖§	8.9 ± 3.9‖	3.9 ± 2.1
Trained			
Back squat	29.9 ± 7.4†‡§‖	12.3 ± 2.5†‖	5.8 ± 2.3†
Bench press	21.7 ± 3.8‖§	9.2 ± 1.6‖	4.0 ± 1.3
Arm curl	19.0 ± 2.9‖§	9.1 ± 2.8‖	4.4 ± 1.9

* $p < 0.05$ vs. corresponding trained group.
† $p < 0.05$ vs. corresponding bench press value.
‡ $p < 0.05$ vs. corresponding arm curl value.
§ $p < 0.05$ vs. corresponding 80% value.
‖ $p < 0.05$ vs. corresponding 90% value.

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Articolo di ricerca (originale)

DISCUSSIONE

In forma critica si analizzano i risultati, comparandoli con studi precedenti e verificando se le ipotesi di partenza dello studio devono essere rigettate o possono essere accettate.

> In conclusion, the number of repetitions that can be performed during free weight exercises at various percentages of 1RM is influenced by the amount of muscle mass used, as exercises that utilize greater muscle mass allow more repetitions to be performed. Interestingly, however, there were minimal differences between T and UT subjects. Therefore, relative load has a fundamental impact on the number of repetitions allowed, since more repetitions can be performed at a lighter load, and this relationship is not appreciably affected by the training status of the subject.

In questa sezione si raggiungono delle conclusioni più o meno certe a seconda della forza delle evidenze dei risultati

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Articolo di ricerca (originale)

BIBLIOGRAFIA

Vengono riportate tutte le fonti da cui si è preso spunto per basare le proprie ipotesi oppure per standardizzare alcune procedure

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Articolo di ricerca (originale)

VARIE…

Alcune riviste contengono delle sezioni varie come ad esempio l'applicazione pratica del risultato evidenziato dalla studio

PRACTICAL APPLICATIONS

If exercise prescription is based on a percent of 1RM: (a) very heavy intensity loads (>90% 1RM) should be used for strength gains in free weight exercises; (b) athletes should be regularly tested for 1RM strength because changes in 1RM will have an effect on the absolute load prescribed during training; and (c) the number of repetitions performed at a given percent of 1RM is, in part, dependent on the absolute muscle mass involved; therefore, when strength coaches prescribe loads based on percent of 1RM, they should be cognizant of the amount of muscle tissue involved in each of the specific lifts. If possible, using RM-based prescriptions is recommended to ensure that the appropriate load is being used for a desired result. However, percent of 1RM can also be used for exercise prescription when free weights are employed to approximate an appropriate exercise intensity.

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Articolo di revisione sistematica (review)

REVIEW ARTICLE

Sports Med 2009; 39 (9): 765-777
0112-1642/09/0009-0765/$49.95/0

RIVISTA

Rest Interval between Sets in Strength Training

TITOLO

Belmiro Freitas de Salles,[1,2] *Roberto Simão,*[2] *Fabrício Miranda,*[2] *Jefferson da Silva Novaes,*[2] *Adriana Lemos*[2] and *Jeffrey M. Willardson*[3]

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Articolo di revisione sistematica (review)

ABSTRACT ***METODI*** ***RISULTATI***

DISCUSSIONE ***VARIE***

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Articolo di revisione sistematica (review)

ABSTRACT

Scopo

Metodi

The purpose of this review is to analyse and discuss the rest interval between sets for targeting specific training outcomes (e.g. absolute muscular strength, endurance, hypertrophy and muscular power). The Scielo, Science Citation Index, National Library of Medicine, MEDLINE, Scopus, Sport Discus and CINAHL databases were used to locate previous original scientific investigations. The 35 studies reviewed examined both acute responses and chronic

Conclusioni

for gains in muscular endurance. In summary, the rest interval between sets is an important variable that should receive more attention in resistance exercise prescription. When prescribed appropriately with other important prescriptive variables (i.e. volume and intensity), the amount of rest between sets can influence the efficiency, safety and ultimate effectiveness of a strength training programme.

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Articolo di revisione sistematica (review)

METODI

Nelle review i metodi spiegano esattamente quali parole chiave sono state usate per collezionare gli studi utili all'analisi della letteratura

investigations. The studies reviewed examined both acute responses and chronic adaptations, with rest interval length as the experimental variable. The search utilized the following keywords: 'rest interval', 'rest period', 'recovery', 'recovery time' and 'fatigue', combined with the keywords 'training volume', 'repetitions', 'sets', 'resistance training', 'resistance exercise' and 'strength training'. The names of authors cited in some studies were also utilized. Hand searches of relevant journals and reference lists obtained from articles were also conducted in the Federal University of Rio de Janeiro and State University of Rio de Janeiro libraries. Such combinations resulted in the inclusion of 35 original research articles addressing the rest interval between sets in strength training. The last search was performed on 17 July 2009.

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Articolo di revisione sistematica (review)

METODI

Inoltre non tutti gli studi presenti in letteratura che corrispondo alle parole chiave scelte vengono presi in considerazione, ma solo quelli che rispettano alcuni punti di "forza" dettati dall'autore della review

Criteria for inclusion were as follows:

1. Only studies from journals with an impact factor ≥1.0. We included this impact factor because the median impact factor for journals in sport science is 1.0, which is similar to that of many other biomedical disciplines. Those with an impact factor <1.0 are considered low-impact journals by the Sports Science Organization.[17]
2. Studies must have examined the effects of the rest interval as the experimental variable on performance, strength, power, hypertrophy and/or muscular endurance.

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Articolo di revisione sistematica (review)

VARIE…

Ulteriore appendice che riassume il contenuto generico della review

5. Recommendations

There is a scarcity of studies concerning chronic adaptations and rest interval length. This review should provide some direction for future studies investigating aspects related to strength, power, hypertrophy and muscular endurance development. Additional investigations concerning acute responses are also necessary, involving women or individuals with different levels of physical conditioning, and potential interactions between the order of exercises and rest interval length. Furthermore, comparison between different rest intervals for exercises that involve relatively large versus small muscle groups would be useful from a practical standpoint. Overall, there is still much research to be done on this topic.

Quando cestinare un articolo

1. Lo studio non affronta temi scientificamente rilevanti

2. Lo studio non è originale (ovvero è stato già ampiamente svolto con gli stessi metodi e li ricalca su campioni simili di soggetti)

3. Lo studio non lavoro sulle ipotesi elencate dagli autori

4. Gli autori sono scesi a importanti compromessi di natura metodologica per sopperire a difficoltà tecniche o tecnologiche

5. Il campione di studio è molto ridotto rispetto allo scopo prefissato

6. Lo studio non è adeguatamente controllato

7. L'analisi statistica non è idonea sia per la numerosità campionaria, sia per aderire al disegno dello studio

8. Le conclusioni non sono coerenti e supportate dai risultati

9. Presenza di conflitti di interessi tra autori e argomenti di studio o metodi o strumentazioni utilizzate

10. L'articolo è strutturato male e poco comprensibile nei metodi

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