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Original article

Anthropometric measurements usage to control the exercise intensity during the performance of suspension rowing and back squats

V.S. Coswig[a,*], C. Dall'Agnol[b], F.B. Del Vecchio[b]

[a] Faculty of Physical Education, Faculty Anhanguera of Pelotas, Brazil
[b] Superior School of Physical Education, Federal University of Pelotas, Brazil

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ABSTRACT

Objective: To verify the reproducibility and sensitivity of the procedure of load prescription from percentages of high and body mass in the suspension rowing (SR) and back squat (BS).
Method: Ten athletes (age: 24.5 ± 3.7 years, weight: 77.8 ± 15.3 kg, height: 172.5 ± 5.1 cm) engaged in resistance training programs were evaluated. BS and RS exercises were performed during four different days, in different intensities. Loads equal to 25% and 50% of body mass were used in the BS. RS exercises were performed with the feet directly under the anchor point and 1/3 of athlete's height away from the anchor point. The highest number of repetitions executed were measured.
Results: No differences were found between test and re-test, with high intraclass correlation coefficient values (ICC > 0.79). The average number of repetitions differ significantly among the exercises performed according to intensity proposed (RS: $p < 0.001$, BS: $p = 0.03$).
Conclusion: The distance of the feet in relation to the zero point seems to be an easy and effective parameter for quantification of loads during RS training. Similarly occurs with the use of the body mass percentage for prescription of BS exercise.

Uso de parámetros antropométricos para controlar la intensidad del ejercicio en el remo en suspensión y sentadillas

Palabras clave:
Levantamiento de pesas
Entrenamiento de fuerza
Reproducibilidad de resultados

RESUMEN

Objetivo: Verificar la reproducibilidad y la sensibilidad del protocolo de prescripción de cargas a partir de porcentajes de la altura y de la masa corporal en los ejercicios de remo en suspensión (RS) y sentadillas (BS).
Método: Se evaluaron 10 sujetos (edad: 24.5 ± 3.7 años, peso: 77.8 ± 15.3 kg, altura: 172.5 ±5.1 cm) que participaban en programas de entrenamiento de resistencia. Se llevaron a cabo ejercicios de RS y BS durante 4 días diferentes, a distintas intensidades. Para BS se utilizaron cargas equivalentes al 25 y al 50% de la masa corporal. Los ejercicios RS se realizaron con los pies directamente debajo del punto de anclaje y a 1/3 de la altura del sujeto respecto a este mismo punto. Se midió el número máximo de repeticiones realizadas.
Resultados: No se encontraron diferencias entre test y retest, con valores altos del coeficiente de correlación intraclase (ICC > 0.79). El promedio de repeticiones difiere de modo significativo, entre los ejercicios realizados, de acuerdo con la intensidad propuesta ($p < 0.001$ y $p = 0.03$, para RS y BS, respectivamente).

* Corresponding author.
E-mail address: vcoswig@gmail.com (V.S. Coswig).

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Conclusión: La distancia de los pies en relación con el punto cero parece ser un parámetro fácil y eficaz para la cuantificación de las cargas durante el entrenamiento RS. Del mismo modo ocurre con el uso del porcentaje de masa corporal para la prescripción de ejercicio BS.

Uso de parâmetros antropométricos para controle da intensidade nos exercícios de remada em suspensão e agachamento

Palavras-chave:
Levantamento de pesos
Treinamento de força
Reprodutibilidade de resultados

R E S U M O

Objetivo: Verificar a reprodutibilidade e a sensibilidade do protocolo de prescrição de cargas, a partir de percentagens da altura e da massa corporal nos exercícios de remada em suspensão (RS) e agachamento (BS).
Método: Foram avaliados 10 sujeitos (idade: 24.5 ± 3.7 anos; massa corporal: 77.8 ± 15.3 kg; estatura: 172.5 ± 5.1 cm) que participavam em programas de treinamento resistido. Foram aplicados os exercícios RS e BS durante 4 dias diferentes, com intensidades distintas. Para BS, foram utilizadas cargas equivalentes a 25 e 50% da massa corporal. Para o exercício de RS foram utilizados os pés diretamente abaixo do ponto de encaixe e a 1/3 da estatura do sujeito em relação a este mesmo ponto. Foi medido o número máximo de repetições realizadas.
Resultados: Não foram encontradas diferenças entre teste e reteste, com valores altos de coeficiente de correlação intraclasse (ICC > 0.79). A média de repetições diferiu de modo significante entre os exercícios realizados, de acordo com a intensidade proposta ($p < 0.001$ e $p = 0.03$, para RS e BS, respectivamente).
Conclusão: A distância dos pés em relação ao ponto 0 parece ser um parâmetro fácil e eficaz para a quantificação das cargas durante o treinamento de remada em suspensão. Do mesmo modo, o uso da percentagem da massa corporal para prescrição de agachamentos.

Introduction

Functional training can be defined as exercises performed in a multiplanar and multi-joint way that simulates specific movements of daily activities and of sportive modalities.[1] Among the different possibilities of strength training, suspension training is widely applied in several contexts. It is considered as an effective technique to improve neuromuscular activation that precedes the use of heavy loads on traditional exercises[2] and, thus, it can be integrated as a component of general warm-up routine.[3] Additionally, improvements in speed and strength indicators are found from the use of suspension training, suggesting increase on recruitment of muscles of central/stabilizer region[4] and decreased incidence of low back pain.[5]

There are three ways to alter the intensity of the suspension exercise by varying a combination of load and stability: (i) Stability Principle: the size and positioning of the base of support (BOS) relative to the center of gravity (COG) determines the stability of an exercise; (ii) Pendulum Principles: the horizontal positioning of the COG relative to the anchor point determines the load of the exercise and (iii) Vector Resistance Principle: the angle of the body relative to the ground determines the load of the exercise.[6] Hence, the possibility of adjusting the resistance of the exercise simply by modifying the position of the body, is a fast and efficient way to prepare a group of athletes simultaneously, each one with individual appropriate load.[3] Nevertheless, there are no scientifically validated parameters for load prescription in the suspension training.

In suspension training, the rowing is a very popular and relevant exercise to promote high relative overload, associated with the muscle integration of the entire body,[5] and it appears to offer considerable advantages to increase the transfer of gains to the physical demands related to sports as the American football[3] and wrestling combat sports.[7]

In addition, the deep back squat (BS) is another form of closed chain exercise widely used in physical fitness programs.[8] Likewise, it is relevant to strength[9] and functionality gains in daily activities.[10] Different from the suspension training that does not have any scientifically proved procedure for intensity prescription, the prescriptions to back squat involve load percentage from maximum repetition test,[11,12] execution time (effort/rest),[13] rate of perceived exertion (RPE),[14] maximum number of repetitions[11] and rep range.[15]

In general, there is a shortage of studies that aim to establish a model for prescribing intensities for functional exercises, since, commonly in the traditional strength training the intensity of the movement is indicated by the amount of load lifted.[16] Only recently, the derivations of body mass percentage have been used in training prescription and strength evaluation.[17] On the other hand, this constitutes a very common technique in fitness programs,[18] despite the absence of studies to check its validity. Therefore, the aim of the study was to verify the reproducibility and sensitivity of the procedure of load prescription from percentages of high and body mass, respectively in rowing in suspension (RS) and deep back squat (BS).

Methods

Subjects

Ten athletes (age: 24.5 ± 3.7 years, weight: 77.8 ± 15.3 kg, height: 172.5 ± 5.1 cm) were evaluated. The inclusion criteria were: (1) to be engaged in resistance training programs during three or more times a week for at least 12 consecutive months, (2) to have previous experience in the proposed exercises and (3) to be without injuries neither in process of rehabilitation. The participants signed a free informed term of consent; the research project follows the ethical guidelines of the Declaration of Helsinki and respects