

**EFFECTOS DE UN ENTRENAMIENTO CON SOBRECARGA EXCÉNTRICA
SOBRE LA FUERZA, LA CAPACIDAD FUNCIONAL Y LA MASA MUSCULAR
EN PERSONAS MAYORES DE 65 AÑOS**

**EFEITOS DE UM TREINAMENTO COM SOBRECARGA EXCÊNTRICA SOBRE
A FORÇA, A CAPACIDADE FUNCIONAL E A MASSA MUSCULAR EM
PESSOAS IDOSAS A PARTIR DE 65 ANOS**

**EFFECTS OF ECCENTRIC OVERLOAD TRAINING ON STRENGTH,
FUNCTIONAL FITNESS AND MUSCLE MASS IN PEOPLE OLDER THAN 65
YEARS**

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RESUMEN

Objetivo: estudiar el efecto de un entrenamiento con sobrecarga excéntrica mediante resistencia inercial, sobre la fuerza, la capacidad funcional y la masa muscular en personas mayores de 65 años.

Métodos: Primero se estableció la carga de trabajo analizando el efecto de tres cargas inerciales diferentes sobre la potencia de miembros inferiores en personas mayores, al ejercitarse en un dispositivo de volantes para el entrenamiento de la fuerza (YoYo™). 20 mujeres y 21 hombres mayores de 65 años realizaron 3 sesiones, cada una con diferente carga y se compararon los valores de potencia concéntrica y excéntrica, media y pico, obtenidos. En un segundo estudio, 20 mujeres (edad: $71,5 \pm 3,9$ años; talla: $153,2 \pm 6,1$ cm; peso: $61,3 \pm 9,7$ Kg) y 19 hombres (edad: $70,6 \pm 3,9$ años; talla: $168,1 \pm 6,9$ cm; peso: $76,3 \pm 9$ Kg) se entrenaron en el mismo dispositivo YoYo™ durante 12 semanas, dos veces semanales, haciendo 4 series de 7 repeticiones máximas de squat supino con la carga seleccionada. 16 mujeres (edad: $69,0 \pm 4,9$ años; talla: $154,2 \pm 5,2$ cm; peso: $61,5 \pm 10,1$ Kg) y 15 hombres (edad: $70,3 \pm 3,9$ años; talla: $164,0 \pm 6,7$ cm; peso: $75,4 \pm 10,9$ Kg) conformaron un grupo control que no se ejercitó. En ambos grupos, antes y después de las 12 semanas, se evaluó la fuerza máxima dinámica (1RM), la fuerza isométrica, la potencia, la capacidad funcional y la masa muscular. Se compararon los valores pre y post de todas las variables.

Resultados: en el estudio 1 las potencias concéntricas media y pico en ambos sexos y la excéntrica en las mujeres, fueron menores con la carga inercial más alta, pero ésta produjo mayor sobrecarga excéntrica en ambos sexos. Aunque la carga inercial más baja aumentó los valores de potencia concéntrica, produjo menor sobrecarga excéntrica. La carga intermedia tuvo un efecto igual en las mujeres y menor en las potencias excéntricas en los varones. Se concluyó que la carga intermedia sería óptima para el entrenamiento. En el segundo estudio, tras el entrenamiento, hubo ganancias del 13,5% en la fuerza isométrica para los hombres y no en mujeres. La RM mejoró 12,3% en hombres y 9,1% en mujeres. La potencia media mejoró para ambos sexos, pero los hombres tuvieron ganancias entre el 40 y el 70% de 1RM y las mujeres sólo al 50 y al 60%. En la potencia pico sólo hubo ganancias para los hombres al 60 y al 80% de 1RM. La fuerza isométrica, la RM y la potencia al dividirse por la masa muscular implicada, mejoraron en ambos sexos significando ganancias en la calidad muscular. La capacidad funcional sólo tuvo cambios para los hombres en sentadillas en 30 segundos y marcha estacionaria. La masa muscular del muslo aumentó 3,5% en las mujeres y 2,9% en los hombres.

Conclusiones: el entrenamiento con sobrecarga excéntrica mediante resistencia inercial, mejora en ambos sexos la RM, la potencia, la masa muscular y la calidad muscular de la zona implicada. La fuerza isométrica sólo mejora en los hombres. La capacidad funcional no parece mejorar, si bien, algunas variables cambiaron en los hombres.

PALABRAS CLAVES: fuerza, capacidad funcional, masa muscular, adultos.

RESUMO

Objetivo: Estudar o efeito de um treinamento com sobrecarga excêntrica mediante resistência inercial, sobre a força, a capacidade funcional e a massa muscular em pessoas idosas a partir de 65 anos.

Método: Primeiro foi determinada a carga de trabalho analisando o efeito de três cargas inerciais diferentes sobre a potência de membros inferiores em pessoas idosas, ao exercitarem-se em um dispositivo de volantes para o treinamento de força (YoYoTM). 20 Mulheres e 19 Homens idosos realizaram três sessões, cada uma com diferentes cargas e foram comparados os valores de potência concêntrica e excêntrica, média e picos obtidos. Em um segundo estudo, 20 mulheres (idade: $71,5 \pm 3,9$ anos; Estatura: $153,2 \pm 6,1$ cm; peso $61,3 \pm 9,7$ kg) e 19 homens (idade: $70,6 \pm 3,9$ anos; altura: $168,1 \pm 6,9$ cm; peso: $76,3 \pm 9$ kg) treinaram no mesmo dispositivo (YoYoTM) durante 12 semanas, duas vezes por semana, executando 4 séries de 7 repetições máximas de squat supino com a carga selecionada. 16 mulheres (idade: $69,0 \pm 4,9$ anos; altura: $154,2 \pm 5,2$ cm; peso: $61,5 \pm 10,1$ Kg) e 15 homens (idade: $70,3 \pm 3,9$ anos; altura: $164,0 \pm 6,7$ cm; peso: $75,4 \pm 10,9$ Kg) formaram o grupo controle que não se exercitou. Nos dois grupos, antes e depois das doze semanas, foram avaliadas a força máxima dinâmica (1RM), a força isométrica, a potência, a capacidade funcional e a massa muscular. Os valores pré e pós de todas as variáveis foram comparados.

Resultados: No estudo 1 as potências concêntricas média e pico, em ambos os sexos e a excêntrica nas mulheres, foram menores com a carga inercial mais alta, porém esta produziu maior sobrecarga excêntrica em ambos os sexos. Embora a carga inercial mais baixa tenha aumentado os valores de potência concêntrica, se produziu menor sobrecarga excêntrica. A carga intermediária teve um efeito igual nas mulheres e menor nas potências excêntricas nos homens. Concluiu-se que a carga intermediária seria ótima para o treinamento. No segundo estudo, após o treinamento, houve incrementos de 13,5% na força isométrica para os homens e não para as mulheres. A RM melhorou 12,3% nos homens e 9,1% nas mulheres.

A potência média melhorou para ambos os sexos, porém os homens tiveram incrementos entre 40 e 70 % de 1RM e as mulheres apenas a 50 e 60 %. Na potência pico só houve incrementos para os homens a 60 e 80 % de 1RM. A força isométrica, a RM e a potência ao ser relativizada pela massa muscular treinada, melhoraram em ambos os sexos obtendo incrementos na qualidade muscular. Só houve melhoras na capacidade funcional para os homens no agachamento em 30 segundos e na marcha estacionária. A massa muscular da coxa aumentou 3,5 % nas mulheres e 2,9 % nos homens.

Conclusões: O treinamento com sobrecarga excêntrica mediante resistência inercial melhora em ambos os sexos a RM, a potência, a massa muscular e qualidade muscular da área envolvida. A força isométrica melhora apenas nos homens. A capacidade funcional parece não melhorar, embora, algumas variáveis tenham apresentado modificações nos homens.

PALAVRAS-CHAVE: força, capacidade funcional, massa muscular, adulto.

ABSTRACT

Objective: We studied the effect of eccentric overload training using inertial resistance on strength, functional fitness and muscular mass in men and women aged 65 years and older.

Methods: Two studies were conducted. The aim of the first study was to analyze the effect of exercising on a YoYo™ flywheel device using three different inertial masses on the power of lower limbs in elderly people. Twenty women and twenty one men completed 3 sessions, each using different loads. The effect of the loads on mean and peak concentric and eccentric power was compared. In the second study, 20 women (71,5±3,9 yr) and 21 men (70,6±3,9 yr) used the same device for 12 weeks, twice a week, carrying out 4 sessions of 7 supine squat repetitions "all out". A control group consisting of 16 women (69,0± 4,9 yr) and 15 men (70,3±3,9) did not exercise. In both groups, the maximum dynamic strength, maximal voluntary isometric contraction (MVIC), power, functional fitness and muscular mass were evaluated before and after the 12 weeks.

Results. In the first study, the mean and peak concentric power (PMEAN and PPEAK) for both sexes, and the eccentric power in women were lower with the highest inertial load. However, the highest inertial load yielded greater eccentric overload peaks in both sexes. Considering that the lowest inertial load increased the concentric power values, it offered less eccentric overload. The effect of the lowest inertial load did not differ from that produced by the intermediate one in women, and it was less noticeable on eccentric power in men. Therefore, we concluded that the intermediate load would be optimal for the proposed training.

In the second study, after completion of training, a 13.5% gain in MVIC was discovered in men but not in women. However, improvement was observed in both sexes when this variable was expressed in values related to lean body mass. The absolute values of maximum dynamic strength improved slightly more in men than in women. These gains were also noticeable with lean body mass-related values. An improvement in both sexes in PMEAN was observed, but it was higher in men than in women. Regarding PPEAK, a maximum dynamic strength gain was only detected in men. When power was related to lean body mass, PMEAN gains were similar for both sexes. A similar result was obtained for PPEAK. Regarding functional fitness, changes were only observed in two out of three tests for men (30 seconds of sit-ups and stationary marching), while no changes were observed in women. Muscular mass increased slightly more in women than in men. These gains and the gains identified for strength were reflected by an improved muscle quality in both sexes.

Conclusions. The results suggest that, first, eccentric overload training using inertial resistance improves maximum dynamic strength, power, and muscular mass in both sexes. The MVIC only improves in men. Second, this form of training does not appear to be suitable for the improvement of functional fitness, even if some variables improve in men. Third, it does improve all strength values related to lean body mass in both sexes, as evidenced by the improvement in muscle quality.

KEY WORDS: strength, functional fitness, muscle mass, adult.

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