



Original article

Acute effects of two different stretching techniques on isokinetic strength and power



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ABSTRACT

Objectives: To examine and compare the acute effects of short duration static and dynamic lower-limb stretching routines on the knee flexor and extensor peak torque and mean power during maximal concentric and eccentric muscle actions.

Method: Forty-nine active adults completed the following intervention protocols on separate days: non-stretching, static stretching and dynamic stretching. After the stretching or control intervention, concentric and eccentric isokinetic peak torque and mean power of the leg extensors and flexors were measured in prone position. Measures were compared via a fully-within-groups factorial ANOVA.

Results: Neither static nor dynamic stretching has influence on isokinetic peak torque and mean power when they were compared with the control condition. Paired comparison also showed that the isokinetic strength and power results reported by dynamic stretching session were slightly higher than those found during the static stretching session.

Conclusions: Short pre-exercise static and dynamic lower-limb stretching routines did not elicit stretching-induced reductions or improvements in knee flexor and knee extensor isokinetic concentric and eccentric strength. In addition, the findings of the current study support the claim that dynamic stretching may be preferable to static stretching as part of a warm-up designed to prepare for physical activity.

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Efecto agudo de 2 técnicas de estiramiento diferentes sobre la fuerza y potencia isocinética

RESUMEN

Objetivos: Examinar y comparar los efectos agudos de una rutina de estiramientos estáticos o dinámicos de corta duración sobre el pico de fuerza máximo y potencia media de la flexión y extensión concéntrica y excéntrica de la rodilla.

Método: Cuarenta y nueve adultos activos completaron los siguientes protocolos de intervención en días separados: no-estiramiento, estiramiento estático y estiramiento dinámico. Después de la intervención de control o estiramiento, el pico de fuerza máximo y la potencia media de la flexión y extensión concéntrica y excéntrica de la rodilla fueron medidos en posición prono. Las medidas fueron comparadas a través de un análisis factorial ANOVA intergrupo.

Palabras clave:

Calentamiento

Fuerza muscular

Pico de fuerza

Potencia

Isocinético

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Resultados: Ni el protocolo de estiramientos estático ni el dinámico tuvieron influencia sobre el pico de fuerza máximo y potencia media isocinética cuando fueron comparados con la condición de control. Las comparaciones por pares también mostraron que los resultados de fuerza y potencia isocinética durante la sesión de estiramientos dinámicos fueron ligeramente mayores que los encontrados durante la sesión de estiramientos estáticos.

Conclusiones: Una rutina de corta duración de estiramientos estáticos o dinámicos del tren inferior no produjo alteraciones en la fuerza isocinética concéntrica y excéntrica de la flexión y extensión de rodilla. Además, los hallazgos del presente estudio apoyan la idea de que el estiramiento dinámico podría ser preferible antes que el estiramiento estático como parte del calentamiento previo a una actuación física.

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Efeito agudo de 2 diferentes técnicas de alongamento sobre a força e potência isocinética

R E S U M O

Palavras-chave:

Aquecimento
Força muscular
Pico de força
Potência
Isocinética

Objetivos: Examinar e comparar os efeitos agudos de uma rotina de alongamentos estáticos e dinâmicos de curta duração sobre o pico de força máxima e potência média da flexão e extensão concêntrica e excêntrica do joelho.

Método: Quarenta e nove adultos ativos completaram os seguintes protocolos de intervenção em dias distintos: sem alongamento, alongamento estático e alongamento dinâmico. Depois da intervenção de alongamento ou controle, o pico de força máxima e a potência média da flexão, extensão concêntrica e excêntrica do joelho foram medidos em posição pronada. As medidas foram comparadas através de uma análise fatorial ANOVA intergrupo.

Resultados: Tanto o protocolo de alongamento estático quanto o protocolo de alongamento dinâmico tiveram influência sobre o pico de força máxima e potência média isocinética quando comparados com a condição controle. As comparações por pares também mostraram que os resultados de força e potência isocinética durante a sessão de alongamento dinâmico foram ligeiramente maiores que os encontrados durante a sessão de alongamento estático.

Conclusão: Uma rotina de curta duração de alongamentos estáticos ou dinâmicos de membros inferiores não produziram alterações na força isocinética concêntrica e excêntrica da flexão e extensão do joelho. Além disso, os achados do presente estudo corroboram com a ideia de que alongamento dinâmico poderia ser preferível ao invés do alongamento estático, como parte do aquecimento antes da atividade física.

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Introduction

Stretching activities before exercise are believed to prepare the musculo-skeletal system for physical activity and sport events by improving joint range of motion, thus promoting improved performance and reducing the relative risk of injury.¹ Consequently, athletes, coaches and sport practitioners regularly include stretching exercises in both training programs and in pre-event warm-up activities.²

However, recent evidence has questioned the traditional hypothesis that supported the practice of pre-exercise stretching as a measure to increase sport performance.^{3,4} In this sense, it has been shown that a bout of static stretching may temporarily reduce strength performance, in relation to force and power production, when it is performed prior to events.^{3,4} It was shown that pre-exercise static stretching might acutely compromise a muscle's ability to produce strength either isometrically^{5,6} or isokinetically⁷⁻¹¹ (mainly under concentric actions) for the knee joint measured throughout a single-joint isokinetic testing protocol. Explanations for this so-called stretching-induced strength deficit include: (a) alterations in the mechanical components of skeletal muscle contraction^{7,8}; (b) decreases in muscle activation^{5,12,13}; or (c) a combination of both mechanical and neural factors.⁷ In contrast, some evidence exists indicating that dynamic stretching exercises may induce improvement in isometric and isokinetic strength and power performance.^{11,14,15} Although the exact mechanisms by which dynamic stretching may improve

strength performance are not well known, previous studies have suggested that a dynamic stretching exercise might exert positive effects on muscular performance by an elevation of muscular temperature,¹⁶ or post-activation potentiation^{14,15} caused by voluntary contractions of the antagonist of the target muscle.

These effects have implications for athletes involved in activities that require maximal strength and power production, such as rugby and football, and have led some researchers to recommend that pre-exercise static stretching should be omitted or replaced by dynamic stretching during warm-ups prior to strenuous exercise and/or sport events. However, when the body of literature regarding the acute effects of pre-exercise stretching on strength and power production is carefully scrutinized, some important limitations are noted, which may question the applicability of the last recommendation in the physical training context. For instance, most of the studies that have investigated the acute effects of static stretching on strength and power have designed protocols which use overall stretch durations on a single muscle group (quadriceps, gastrocnemius and hamstrings mainly), ranging from 90 s to 60 min.^{5,12-17} These single muscle group and long stretching protocols are not representative of typical warm-ups used by athletes and recreationally active people to prepare for exercise or competition.¹⁸ Furthermore, very few studies have carried out direct comparisons between stretching protocols with consistent stretch doses (overall and single stretching duration) and different stretch techniques (i.e. static vs dynamic stretching) on concentric and/or eccentric maximal isokinetic strength and power output to elucidate the

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