124 - STRETCHING EXERCISES USED TO WARM UP DO NOT IMPROVE 1-RM PERFORMANCE OF VOLLEYBALL PLAYERS

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INTRODUCTION

In sports training the muscle strength and flexibility are physical capacities often trained.

The main motors actions in volleyball are classified as high intensity and with short duration, the fast strength within stretch-shortening cycle manifests itself in a specific way (CHAGAS *et al*., 2002).

Stretching exercises are frequently used as warm up of many sports activities and it is regarded as the main resources used to train flexibility (LIMA, CARNEIRO,1999)

The stretching exercises are used to prevent injury (WITVROUW *et al*., 2004) and improve physical performance (SHERLOCK, PRENTICE, 1985). However, these objectives are not entirely clear (HERBERT, GABRIEL, 2002; SHRIER, 2004).

Some studies found decrease of the muscle strength performance after stretching exercises (KOKKONEN *et al*., 1998; AVELA *et al*., 1999; FOWLES *et al*., 2000; TRICOLI, PAULO, 2002; ZAKAS *et al*., 2006), and they have questioned the use of them as preparatory activities in some sports.

Fowles *et al*., (2000) attributes the strength reduction to myogenic and neural factors, such as change in muscle properties and reduction of excitability of alpha motoneurons.

It has been shown that stretching exercises alter the muscle-tendon unit properties (MAGNUSSON, 1998) and the passive tension and stiffness of muscles (KUBO *et al*., 2001). The level of stiffness of the muscle-tendon unit relates in a positive way with the production of strength in concentric and isometric actions (Wilson *et al.*, 1994), therefore, there is a possibility that stretching exercises affect the transference of force of the muscle-tendon unit to the skeletal system, because a lower stiffness leaves the muscle-tendon unit more complacent.

Different tests of strength and the configuration of the load used for training are factors that can lead to a misinterpretation, therefore the results are difficult to analyze due to the lack of specificity when compared to the daily practice.

Some studies have evaluated the muscle strength through single joints isometric tests (AVELA *et al.*, 1999; Fowler *et al*., 2000), isokinetic (ZAKAS *et al*., 2006) and concentric (Kokkonen *et al*., 1998), which are not considered specific actions to assess complex motor movements that occur in sports.

Therefore the main purpose of this study was to verify if stretching exercises used as preparatory activity for these athletes decreases the performance test of the 1-RM.

Materials and methods

Sample

The sample was composed by 12 female volleyball players (19,6 ± 2,1years; 68,2 ± 4,8 Kg; 177 ± 0,06 cm, Tab.1). All the athletes were classified in the following criteria: have trained volleyball for three years, be experienced in weight train and have no recent history of injuries on lower limbs or lumbar spine.

All participants in the study signed an informed consent form, which agreed to be voluntary.

Anthropometric measures

The body mass and height of the athletes were measured using a Filizola® scale with a stadiometer coupled, the precision were 0,1 Kg and 0,5 cm, respectively.

Procedures

Three test sessions were performed. The first session was for familiarization and the other two were for experimentation. An interval period of 48 hours among the sessions was given. Any type of physical training was not performed during the whole period of the data collection, that lasted one week.

In the experimental sessions the athletes were randomly divided into to groups, **A** and **B**.

In the first experimental session the athletes in group **A** ran for 10 minutes in a self selected velocity, they performed the stretching exercises protocol and performed the 1-RM test. The athletes in group **B** ran in a self selected velocity and performed the 1-RM test. In the second experimental session the groups were reversed, the group **A** ran and performed the 1-Rm test. The group **B** ran and performed the stretching exercises protocol and tested of 1-RM.

1-RM test

The smith machine *Physicus*® was used to perform the 1RM test. The range of motion of the squat exercise was 90º in the eccentric phase and complete knee extension in the concentric phase.The 1-RM test protocol was performed as follows: 5 trials with a rest interval of 5 minutes among them (ACSM, 2003). The execution of 1-RM test was always preceded by a preparatory set of 8 repetitions of squat exercise with 60% of maximum weight found in the familiarization session.

Stretching exercises

The athletes performed 7 stretching exercises to lower limbs through passive static stretching (maximum gluteus$_{(1)}$, hamstring$_{(1)}$, quadriceps$_{(1)}$ and calf$_{(1)}$) and active static stretching (quadriceps$_{(1)}$, hamstring$_{(1)}$ and calf$_{(1)}$). It was performed 2 repetitions of 15 seconds, the intensity was up to the point of discomfort of each athletes, without rest interval between repetitions and exercises. These procedures were based on preparatory activities performed by these athletes daily.

Statistical analysis

To verify the differences in the values of 1-RM tests in both experimental conditions (preceded and not preceded by stretching exercises), a paired T test for repeated samples was used, which was done in the statistical program SPSS for Windows version 13.0. The significance level was $p<0.05$.

RESULTS

The descriptive characteristics of the sample are represented in Table 1.

In the experimental condition, the 1-RM test that was preceded by stretching exercises had a mean (111.66 ± 13.17 kg) that was not significantly different from the non stretching condition (112.66 kg ± 13.22) (Tab.2).

Table 1 Descriptive characteristics

Values	Age (years)	BM (Kg)	Height (cm)
Mean	19,06	68,20	177,00
SD*	2,01	4,80	0,06

*SD- Standard deviation

Table 2 Descriptive results of the 1-RM test in both experimental sessions.

Session	Minimum	Maximum	Mean	SD
1-RM (stretching)	96 Kg	136 Kg	111,66	13,17
1-RM (without stretching)	96 Kg	140 Kg	112,66	13,22

Discussion

The study results showed that there was no decrease in the performance of 1-RM test for the squat movement after the performed stretching exercises.

These results contradicts several studies (KOKKONEN *et al*., 1998; AVELA *et al*., 1999; FOWLES *et al*., 2000; TRICOLI; PAULO, 2002; ZAKAS *et al*., 2006), because all of them verified decreases in the muscle strength after stretching exercises.

Analyzing these researches it is possible to notice that the training load used in the stretching exercises were very high, when compared with the daily routine in some sports. The total duration of stretching exercises varied considerably, 3600 seconds (AVELA *et al*., 2000), 1755 seconds (Fowles *et al*., 2000), 540 seconds (TRICOLLI; PAULO, 2002), 300 and 400 seconds (ZAKAS *et al* ., 2006) and 450 seconds (Kokkonen *et al*., 1998).

The present study used a total duration of 210 seconds that approaches more the sports reality. Corroborating with Zakas *et al*., (2006) which found no difference in the strength performance in the protocol that used a total duration suitable with the sports practice (30 seconds).

The tests used to measure the muscle strength by some studies are not considered specific actions to assess complex motor movements that occur in sports. Much of them used isometrics single joints, isokinetic single joints tests (ZAKAS *et al*., 2006) and concentric single joints (KOKKONEN *et al.,* 1998).

According to McBride *et al*., (2005), the same flexibility load training can cause a reduction in the maximum strength in an isometric single joint test without any change in multi joints test, which may be justified by the assumption that the loss of muscle strength by agonists is offset by greater activation of other muscles. It is possible that the pattern of recruitment of motor units also may be different between single and multi joints actions for the concentric contractions.

In an attempt to bring the tests to practical reality, another important factor that should be taken into consideration is that in a stretching routine it is common to stretch more than one muscle group. Thus, studies must be conducted by performing the stretch for several muscle groups, which is not observed in some studies (AVELA *et al*. 1999; FOWLES *et al.,* 1999).

A methodological flaw of this study, as well as from other studies was not verifying whether the training load that was applied produced a significant effect on increasing the flexibility (AVELA *et al*., 1999; TRICOLI; PAULO, 2002), while in others studies the flexibility was measured by non specific test (KOKKONEN *et al*., 1998). Kokkonen *et al*., (1998) used the sit and reach test to measure the flexibility of the thigh muscles after stretching, which has been criticized (HUI, YUEN, JACKSON & MORROW, 1999) by not taking into account anthropometric differences between individuals. Thus, it is not possible to verify whether the experimental treatment caused significant changes in ROM, because the same individual can perform the test and get different results depending on the spine flexion degree and scapula abduction, therefore, it is not possible to associate the experimental treatment with the decline in strength performance.

Conclusion

We can conclude that these stretching exercises with the load configuration used in this study, did not decrease the performance in the 1-RM test for the squat movement of these athletes.

It is important to emphasize that more research on the subject is required, since the literature is very divergent. It is important that future researches employs more specific strength and flexibility tests and flexibility training loads that are more applicable to the daily routine in sports.

Key words: athletes, preparatory activities, muscle strength.

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STRETCHING EXERCISES USED TO WARM UP DO NOT IMPROVE 1-RM PERFORMANCE OF VOLLEYBALL PLAYERS

ABSTRACT

The purpose of this study was to verify if stretching exercises as preparatory activity for these athletes decrease the performance of the one repetition maximum (1-RM).The sample it was composed 12 female volleyball athletes with mean age, height, body mass (±SD) were 19,6 ± 2,1years; 68,2 ± 4,8 Kg; 177 ± 0,06 cm, respectively, all the subjects signed an informed consent form. They performed 3-test sessions of 1-RM (interval of 48 h among all sessions).The first one was of familiarization and the other two were of experimentation, with and without stretching exercises. The squat exercise was selected and performed in a smith machine, by the proximity to the movement of volleyball jump. In the first experimental session (session 1) the athletes ran for 10 minutes in a self-selected velocity and performed stretching exercises (2 repetitions, 15 seconds stretch) for lower limbs muscles (passive static stretching exercises=maximum gluteus(1), hamstring(1) quadriceps(1) and calf(1), active static exercises=quadriceps(1), hamstring(1) and calf(1)). Thereafter the athletes were submitted the 1-RM test. In the session 2 the athletes repeated the session 1 procedure, without the stretching exercises program. An alpha level of $p<0,05$ was considered significant. The experimental sessions were randomized. To compare the 1-RM performance between session 1 and 2 a paired *t*-test was used. Significant difference was not found in 1-RM ($p< 0,389$). The stretching exercises have not negative influence in 1-RM performance of these volleyball athletes.

EXERCICES D'ÉTIREMENT UTILISÉ POUR RÉCHAUFFER NE PAS AMÉLIORER LA 1-RM PERFORMANCE DES ATHLÉTES DE VOLLEY-BALL

RÉSUMÉ

Le but de cette étude était de déterminer si les exercices d'étirement pour les utiliser comme activité préparatoire pour ces athlètes diminuer dans le revenu d'essai pour une répétition maximale (1-RM) de moitié squat. A échantillon était composé de douze athlètes de volley-ball féminin à partir de l'âge moyen, la hauteur et de masse corporelle,19,6 ± 2,1 ans; 68,2 ± 4,8 kg, 177 ± 0,06 cm, respectivement. Tous les athlètes ont signé un consentement libre et éclairé. Trois sessions d'essai de 1-RM (de 48 heures entre toutes les sessions). La première a été de se familiariser et les deux autres expériences, avec et sans l'exercice d'un tronçon. L'exercice a été mené à l'accroupissement sur une visite guidée de bar, et a été sélectionné par la proximité des mouvements de saut en volley-ball. Au cours de la première session du procès des athlètes a couru pendant 10 minutes à une vitesse auto-sélectionné, effectué des exercices d'étirement (2 répétitions de 15 secondes) pour les membres inférieurs (années de passif-statique = grand fessier (1), postérieure cuisse (1), Quadriceps (1) et triceps surae (1) des exercices et des quadriceps active statique = (1), la cuisse postérieure (1) et triceps surae (1). Après que les athlètes ont été soumis à l'analyze de 1-RM, moitié squat. Dans la deuxième réunion les athlètes répété les procédures de la session 1, sans le program de l'étirement. Le niveau de signification de 0,05. Pour comparer le rendement de 1 RM-test entre les sessions 1 et 2 a été utilisé un T-test. Il n'y avait pas de différences significatives lors de l'épreuve de 1-RM ($p <0389$). Ces exercices longueur n'a pas d'influence de rendement dans l'épreuve du 1-RM de ces athlètes.

LOS EJERCICIOS DE ESTIRAMIENTO HIZO COMO ACTIVIDAD PREPARATÓRIA NO REDUCIR EL RENDIMIENTO DE 1 RM EN LAS ATLETAS DE VOLEIBOL

RESUMEN

El objetivo de este estudio fue comprobar si los ejercicios de estiramiento para su uso como actividad preparatoria para estos atletas diminuim el rendimiento en la prueba de una repetición máxima (1-RM) a squat. La muestra estuvo constituida por doce atletas de voleibol femenino de la edad media, altura y masa corporal el 19,6 ± 2,1 años; 68,2 ± 4,8 kg, 177 ± 0,06 cm, respectivamente. Todas las ninas atletas firmaron un consentimiento libre e informado. Tres sesiones de 1-RM fueron evaluados (intervalo de 48 horas entre todos los períodos de sesiones). El primero fue para la familiarización y los otros dos experimentos, con y sin ejercicio de un tramo. El ejercicio se llevó a cabo para en squat sobre una barra de guía, y fue seleccionada por la proximidad de los movimientos de salto en voleibol. En el primer período de sesiones experimentales las atletas corrió durante

10 minutos a una velocidad de la libre seleccionados, realiza ejercicios de estiramiento (2 repeticiones de 15 segundos) para las extremidades inferiores (años de pasiva-static = glúteo maximus (1), muslo posterior (1), Cuadríceps (1) y tríceps surae (1) ejercicios de cuadriceps y activa estática = (1), posterior del muslo (1) y tríceps surae (1). Después de que las atletas fueron sometidas a análisis de 1-RM. En el segunda session de las atletas repite los procedimientos del período de sesiones 1, sin el programa de estiramiento. El nivel de significación de 0,05. Para comparar el rendimiento de 1-RM entre las sesiones 1 y 2 se utilizó uno *test-t*. No hubo diferencias significativas en lo experimento de 1-RM (p <0,389). Estos ejercicios de estiramiento no tenía ninguna influencia en el rendimiento de la session de 1-RM de estos atletas.

EXERCÍCIOS DE ALONGAMENTO UTILIZADOS COMO ATIVIDADE PREPARATÓRIA NÃO DIMUNUEM O RENDIMENTO DE 1-RM EM ATLETAS DE VOLEIBOL

RESUMO

O objetivo deste estudo foi verificar se exercícios de alongamento utilizados como atividade preparatória por estas atletas diminuem o rendimento no teste de uma repetição máxima (1-RM) de agachamento. A amostra foi composta por doze atletas de voleibol feminino com média de idade, altura e massa corporal (±Dp), 19,6 ± 2,1anos; 68,2 ± 4,8 Kg; 177 ± 0,06 cm, respectivamente, todas as atletas assinaram um termo de consentimento livre e esclarecido. Foram realizadas três sessões de teste de 1-RM (intervalo de 48 h entre todas as sessões). A primeira foi para familiarização e as outras duas experimentais, com e sem exercícios de alongamento. O exercício de agachamento foi realizado em uma barra guiada, e foi selecionado pela proximidade ao movimento de salto no voleibol. Na primeira sessão experimental as atletas correram por 10 minutos a uma velocidade auto selecionada, realizaram exercícios de alongamento (2 repetições de 15 segundos) para os membros inferiores (exercícios de alongamento passivo-estático = glúteo máximo(1),posteriores da coxa(1), quadríceps(1) e tríceps sural(1) e exercícios ativo estático= quadríceps(1), posteriores da coxa(1) e tríceps sural(1). Depois disto as atletas foram submetidas ao teste de 1-RM. Na segunda sessão as atletas repetiram os procedimentos da sessão 1, sem o programa de alongamento. O nível de significância adotado de p<0,05.Para comparar o rendimento do teste de 1-RM entre as sessões 1 e 2 foi usado um teste t-pareado. Não foram encontradas diferenças significativas no teste de 1-RM (p<0,389). Os exercícios de alongamento não tiveram influencia no rendimento do teste de 1-RM destas atletas.