202 - BICEPS BRACHII MUSCLE ACTIVATION IN TRAINED AND UNTRAINED SUBJECTS DURING ELBOW FLEXION WITHOUT VISUAL FEEDBACK

MONIQUE SERAPICOS,
TATIANE VIEIRA,
MÁRCIA ALBERGARIA.
Universidade Estácio de Sá - Rio de Janeiro - RJ - Brasil
moniqueserapicos@yahoo.com.br

INTRODUCTION

Recently, strength training has been gaining importance within exercise training programs given the innumerous benefits reported in scientific studies, while being supported by the largest associations in the world associated to health, such as *American College of Sports Medicine* and *American Heart Association* (POLLOCK, VINCENT, 1996; ACSM, 2002). Currently, it is known that performing a voluntary motor task results in the integration among the nervous, musculoskeletal, and sensory systems, generating a motor control and a postural control adequate to that condition, whereas the integration between these two types of controls generate an efficient movement action (BIGONGIARI et al., 2005; TEIXEIRA, 2006).

The motor control refers to the specific generation of action, that is, the control of activation of primary muscles of the motor task (BIGONGIARI et al., 2005). To obtain an efficient motor control it is necessary an anticipation of movement, where the planning of action occurs, the stimulation of primary muscles, and its consequent activation, in a period between the intention of movement execution and the actual movement called anticipatory adjustments (TEIXEIRA, 2006). This period determines the preparation to the movement, where the more efficient the action planning is, the less corrections will be necessary, that is, less compensatory adjustments are needed (SHUMWAY-COOK, WOOLLACOTT, 2003; TEIXEIRA, 2006). Postural control is related to an adequate body orientation to the maintenance of stability throughout the movement (SHUMWAY-COOK, WOOLLACOTT, 2003).

Surface electromyography is characterized by a non-invasive method of capturing electrical activity produced by the muscle, relating to muscle activation, being greatly used to study neuromuscular function (HALL, 2005; RASH, 2004).

In this manner, the present study sought to compare the muscle activation of the biceps brachii between trained and untrained subjects when subjected to the execution of elbow flexion with the absence of visual feedback, considering most studies analyzing motor control have used populations consisting of children or the elderly (BIGONGIOARI et al., 2005; BONFIM et al., 2005; MOCHIZUKI et al., 2005).

METHODS

This descriptive study sought to analyze data obtained from electromyography of the biceps brachii muscle, comparing its activation between trained and untrained subjects during the execution of elbow flexion with the eyes closed (THOMAS & NELSON, 2006).

The study presented a sample consisting of 8 subjects of the male gender, students of Physical Education, being 4 trained and 4 untrained, apparently healthy (ACSM, 2002), with a mean age of 23 ± 2.4 years, body mass = 75.9 ± 8.98 kg (Welmy Scale), and height = 1.75 ± 0.05 m (Sanny Scale). Trained status was considered for those who took part in strength training for at least six months and untrained for those who did not. All participants read and signed an informed consent form.

Subjects performed a specific warm-up before the test, with a light load determined by the subjects themselves. Afterwards, the subjects were submitted to a test of 1-RM (44.25 ± 7.7 kg), to determine the maximum load and the test load, which was set at 80% of 1-RM (35.5 ± 6.7 kg). When more than one attempt was necessary, a rest period of 5 minutes was allowed. After the test load was determined, subjects were prepared for the placement of surface electrodes of Ag/AgCl (MediTrace), disposable and with 1 cm of diameter, in a bipolar configuration (20mm of distance), aiming to minimize noise, over the center of the muscle belly (DE LUCA, 2005). A reference electrode was placed laterally over the left leg of the subjects. Electrical activity of the biceps brachii (BB) muscle was captured by a system of biological signal acquisition EMG1000-12-4I (Lynx® - Tecnologia Eletrônica Ltda), with a sample frequency of 2000 Hz. The signals were filtered with high bandpass filter of 500 Hz and a low bandpass filter of 10 Hz. The biological signal acquisition was made by the software Bionspector 1.8 (Lynx® - Tecnologia Eletrônica Ltda) and the analysis with the software AqdAnalysis 7 (Lynx® - Tecnologia Eletrônica Ltda). The EMG signal was converted from analog to digital by means of a CAD1026 Lynx board with inputs to 2 V. Data collection was performed in the Biomechanics Laboratory of the Estácio de Sá University (Akxe Campus), located in the neighborhood of Barra da Tijuca, in the city of Rio de Janeiro. The surface electromyography generated a Root Mean Square (RMS) value for the muscle analyzed in the 5 seconds prior to the movement execution and during the 3 repetitions of elbow flexion. From this period prior to the start of movement, that is, the period of anticipatory adjustments, a statistical analysis used the period between the increase of the electromyography signal above the levels of rest and the start of the movement execution. The task consisted of the execution of the elbow flexion in the orthostatic posture with eyes closed, using a bar of 110 cm in length, with the hands in the supinated position and bare feet, placed parallel apart and in a distance determined by the participant. For all statistical analysis data were analyzed using the software SPSS version 15.0 (SPSS Inc., Chicago, IL), where statistical differences were established using t-tests, with a significance level of $p < 0.05$.

ANALYSIS AND DISCUSSION OF RESULTS

The trained subjects presented lower anticipatory adjustments (AA) compared to untrained subjects. However, with significantly greater muscle activation ($p > 0.02$) suggesting a more efficient planning of action in the absence of visual feedback, which can be explained by the practice of exercise allowing the storage of characteristics specific to the movement, resulting in a more efficient preparation.

The data also demonstrated the need for a lower interval period for the three repetitions of elbow flexion for the trained subjects, suggesting that the more efficient planning of action generated a lower need for compensatory adjustments throughout and thus a more efficient execution.

The activation of the biceps brachii demonstrated to be lower for the untrained throughout the movement when compared to the trained, which can be explained by the neuromuscular adaptation generated by the training, that is, by the increase in voluntary activation (FLECK, KRAEMER, 2006).

Subjects	Anticipatory Period	Anticipatory Activation	Execution Period	Activation During Execution
Trained	2.91	84.95*	4.42	389.69
Untrained	2.99	15.49*	4.70	290.55

Mean of the anticipatory period, anticipatory activation of the Biceps Brachii, execution period, and activation of the Biceps Brachii throughout the movement. (* $p > 0.02$)

CONCLUSIONS AND RECOMMENDATIONS

The results presented demonstrate that trained subjects appear to present a more consistent planning of action in the absence of visual feedback, reflecting in a significantly greater ($p > 0.02$) activation compared to the untrained in this condition. Consequently, lower corrections are needed, that is, compensatory adjustments throughout the movement. The results from the study corroborate with the findings in the literature that consider the regular practice of exercise turns the individuals partially independent of the visual feedback (TEIXEIRA, 2006).

It is recommended that more studies are done considering an adult population. However, with a greater subject sample and diversity, give the biased sample used in the current study (students of Physical Education).

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ABSTRACT:

Introduction: Motor control is performed based on the integration of the nervous, musculoskeletal, and sensory systems, resulting from the previous structure of the movement along with a regulation via sensory feedback. Prior to the start of the movement execution, the muscles are activated with the goal of preparing the movement action seeking for a greater motor efficiency. In this manner, during an movement action, a regulation of muscle activation occurs with the sensorial information coming from the surrounding. **Objective:** The present study aimed to compare the muscle activation of the biceps brachii between trained and untrained subjects when performing elbow flexion without visual feedback. **Methods:** The sample constituted of 4 trained and 4 untrained subjects, being considered trained those who took part in strength training for at least the previous 6 months. The test consisted of performing the elbow flexion with a load equivalent to 80% of 1-RM, as defined by a 1-RM test, with eyes covered and an underhand grip. The electromyography signal was recorded with disposable surface electrodes (MediTrace) in the 5 seconds prior to the movement execution and throughout the exercise. Hence, the RMS value for the muscle analyzed was obtained and a statistical analysis with t-tests was used ($p < 0.05$). **Results:** The statistical analysis revealed greater ($p < 0.02$) anticipated activation of the biceps brachii muscles for trained subjects compared to untrained subjects. The results also demonstrate a tendency for greater muscle activation throughout the movement for trained subjects, although this difference did not reach statistical significance. Thus, the data suggest trained subjects present a more consistent structure prior to the movement, that is, they presented a better planning of action that is more efficient. **Conclusion:** The results mentioned demonstrate that trained subjects present a movement strategy that is more efficient in the resulting action of a better structure of movement. In this manner, the data reveal that the regular practice of exercise allowed the storage of characteristics which were specific to the movement by trained subjects, generating a better preparation that was more efficient, which is similar to findings in the literature.

Keywords: motor control; electromyography; strength training

ACTIVATION DU BICEPS BRACHIAL POUR SUJETS INSTRUITS ET DESTREINADOS PENDANT LA FLEXION DU COUDE EN L'ABSENCE D'INFORMATIONS VISUELLES

RESUMÉ

Introduction: Le contrôle moteur est réalisé à partir de l'intégration des Systèmes Nerveux, de Músculo-Esquelético et Sensorial, en résultant de la structuration préalable du mouvement allié au règlement voyait feedback sensoriel. Précédemment au début de l'exécution du mouvement, les muscles efetores sont activés avec l'objectif de préparation de l'action en cherchant une plus grande efficacité motrice. De cette façon, pendant l'action se produit le règlement de l'activation musculaire conformément aux informations sensorielles arrivées du moyen. **Objectif:** Présente étude il a cherché comparer l'activation du muscle Biceps Brachial entre des sujets instruits et destreinados quand soumises à l'exécution de la flexion du coude en l'absence d'informations visuelles. **Méthodologie:** L'échantillon a été constitué de 4 sujets instruits et 4 sujets destreinados, en étant considérées entraînées ces praticiens de formation de force par une période minime de 6 mois. L'essai a consisté à la réalisation de la flexion du coude avec chargement équivalent à 80% de 1-RM, définie à partir de l'essai de 1-RM, en ayant les yeux vendados et les mains supinadas. Le signe eletromiográfico a été capté à partir d'électrodes superficielles jetables (MediTrace) dans les 5 seconds précédents à l'exécution du mouvement et au long du même. Alors, la valeur RMS pour le muscle analysé est obtenue et s'est réalisée l'analyse statistique à partir de l'essai « t » de Student ($p < 0,05$). **Résultats**: L'analyse statistique a montré une activation anticipée significativement plus grand ($p < ; 0,02$) du muscle Biceps

Brachiaux pour les sujets entraînés concernant les destreinados. Les résultats montrent encore à une tendance la plus la plus grande activation du muscle au long du mouvement pour les sujets entraînés, malgré la différence entre les conglomérats n'aient pas été significatifs. Les données suggèrent que les sujets instruits aient présenté une structuration préalable du mouvement le plus cohérent, c'est-à-dire, ont présenté une planification plus efficace de l'action. **Conclusion** : Les résultats susmentionnés montrent que les sujets instruits ont présenté une planification plus efficace de l'action résultant de meilleure structuration du mouvement. De cette façon, les données montrent que la pratique régulière de l'exercice a permis le stockage de caractéristiques propres du mouvement par les sujets entraînés, en produisant une préparation plus efficace du même, en corroborant avec les trouvailles de la littérature.

Mots-clé: il contrôle moteur ; eletromiografia ; force

ACTIVACIÓN DEL MÚSCULO DEL BICEPS-BRACHII EN TEMAS ENTRENADOS E INEXPERIMENTADOS DURANTE LA FLEXIÓN DEL CODO SIN LA REGENERACIÓN VISUAL

RESUMEN:

Introducción: Se realiza el control de motor basó en la integración de los sistemas nerviosos, musculoesqueléticos, y sensoriales, resultando de la estructura anterior del movimiento junto con una regulación vía la regeneración sensorial. Antes del comienzo de la ejecución del movimiento, los músculos se activan con la meta de preparar la acción del movimiento que busca para una mayor eficacia del motor. De este modo, durante una acción del movimiento, una regulación de la activación del músculo ocurre con la información sensoria que viene del cerco. **Objetivo:** El actual estudio apuntó comparar la activación del músculo del biceps-brachii entre los temas entrenados e inexperimentados al realizar la flexión del codo sin la regeneración visual. **Métodos:** La muestra constituida de 4 temas entrenados y 4 inexperimentados, siendo considerado entrenado los que participaron en el entrenamiento de la fuerza por lo menos los 6 meses anteriores. La prueba consistió en el realizar de la flexión del codo con una carga equivalente hasta el 80% de 1-RM, según lo definido por una prueba 1-RM, con ojos cubiertos y un apretón secreto. La señal de la electromiografía fue registrada con los electrodos superficiales disponibles (MediTrace) en los 5 segundos antes de la ejecución del movimiento y a través del ejercicio. Por lo tanto, el valor del RMS para el músculo analizado fue obtenido y un análisis estadístico con las t-pruebas fue utilizado (< de p; 0.05). **Resultados:** El análisis estadístico reveló mayor (< de p; 0.02) activaciones anticipadas de los músculos del biceps-brachii para los temas entrenados compararon a los temas inexperimentados. Los resultados también demuestran una tendencia para la mayor activación del músculo a través del movimiento para los temas entrenados, aunque esta diferencia no alcanzara la significación estadística. Así, los datos sugieren el presente entrenado de los temas una estructura más constante antes del movimiento, es decir, presentaron un mejor planeamiento de la acción que es más eficiente. **Conclusión:** Los resultados mencionados demuestran que los temas entrenados presentan una estrategia del movimiento que sea más eficiente en la acción resultante de una mejor estructura del movimiento. De este modo, los datos revelan que la práctica regular del ejercicio permitió el almacenaje de las características que eran específicas al movimiento por los temas entrenados, generando una mejor preparación que era más eficiente, que es similar a los resultados en la literatura.

Palabras- claves: control motor; electromiografía; entrenamiento de la fuerza

ATIVAÇÃO DO BÍCEPS BRAQUIAL PARA SUJEITOS TREINADOS E DESTREINADOS DURANTE A FLEXÃO DO COTOVELO NA AUSÊNCIA DE INFORMAÇÕES VISUAIS

RESUMO:

Introdução: O controle motor é realizado a partir da integração dos Sistemas Nervoso, Músculo-Esquelético e Sensorial, resultando da estruturação prévia do movimento aliada à regulação via feedback sensorial. Anteriormente ao início da execução do movimento, os músculos efetores são ativados com o objetivo de preparação da ação buscando uma maior eficiência motora. Deste modo, durante a ação ocorre a regulação da ativação muscular de acordo com as informações sensoriais vindas do meio. **Objetivo:** O presente estudo buscou comparar a ativação do músculo Bíceps Braquial entre sujeitos treinados e destreinados quando submetidos à execução da flexão do cotovelo na ausência de informações visuais. **Metodologia:** A amostra foi constituída de 4 sujeitos treinados e 4 sujeitos destreinados, sendo considerados treinados aqueles praticantes de treinamento de força por um período mínimo de 6 meses. O teste consistiu na realização da flexão do cotovelo com carga equivalente a 80% de 1-RM, definida a partir do teste de 1-RM, tendo os olhos vendados e as mãos supinadas. O sinal eletromiográfico foi captado a partir de eletrodos superficiais descartáveis (MediTrace) nos 5 segundos anteriores à execução do movimento e ao longo do mesmo. Então, o valor RMS para o músculo analisado foi obtido e realizou-se a análise estatística a partir do teste "t" de Student ($p < 0.05$). **Resultados:** A análise estatística mostrou uma ativação antecipada significativamente maior ($p < 0.02$) do músculo Bíceps Braquial para os sujeitos treinados em relação aos destreinados. Os resultados mostram ainda uma tendência à maior ativação do músculo ao longo do movimento para os sujeitos treinados, ainda que a diferença entre os conglomerados não tenha sido significativa. Os dados sugerem que os sujeitos treinados apresentaram uma estruturação prévia do movimento mais consistente, ou seja, apresentaram um planejamento mais eficiente da ação. **Conclusão**: Os resultados supracitados mostram que os sujeitos treinados apresentaram um planejamento mais eficaz da ação resultante da melhor estruturação do movimento. Deste modo, os dados mostram que a prática regular do exercício permitiu o armazenamento de características próprias do movimento pelos sujeitos treinados, gerando uma preparação mais eficiente do mesmo, corroborando com os achados da literatura.

Palavras- chave: controle motor; eletromiografia; treinamento de força