## 63 - CHANGES IN PHYSIOLOGICALS AND BIOMECHANICS PARAMETERS DURING INTERVAL SET IN UPPER BODY EXERCISE FOR TRAINED INDIVIDUALS

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**INTRODUCTION**

Currently the strength training is used as a mode of practice exercises for widespread training in the middle of sports and recreation in practice and even during recovery from disease. Building morphofunctional adjustments both in skeletal muscle, as in the heart, these changes may occur in chronic and acute, dependent on combinations of many variables. According to Kramer et al. (2000) may be the number of runs, quantity, type and sequencing of the exercises, as well as the recovery time between series made. However, the time interval between series may be crucial to achieving the desired results, thus, the objective of this study was to investigate the biomechanical changes (articulate kinematics and the level of maximum activity (root mean square-RMS)) and physiological (lactate) of the muscles involved in the exercise bech press in interval set trained individuals.

**MATERIALS AND METHODS**

The experimental group was composed of five volunteers ($26.2 \pm 5.6$ years; $77.54 \pm 9.56$ kg, $168.1 \pm 4.20$ cm), all trained with more than two years of experience with the movement studied. As a criterion for inclusion, they could not show any injury myo-osteo-articular in the upper limb. All volunteers were informed about the objectives and procedures of the study and signed a free and informed consent that was previously approved by the Ethics Committee of the University Center North, Manaus, AM, with the protocol CEP-016-07.

Four sessions were conducted during the experimental procedure. In session 1 was found anthropometric measurements in session 2 and 3 were performed test and retest to obtain the maximum load for 10RM, respectively, in session 4 to collect the kinematic data, electromyographic and lactate. Between 1 and 2 meeting were adopted 24 hours apart, already between 2 and 3 were 48 hours and between 3 and 4, were given 72 hours trying to prevent accumulation of fatigue that could compromise the results.

The exercise bench press was selected because of their great job in training programs and experimental investigations. The load used was estimated from the completion of a test that was performed on two different days, which are separated by a minimum of 48 hours, and the results showed differences between test and retest, $92.44 \pm 18.24$ and $98,22 \pm 16.98$ for $p < 0.05$, respectively, loading obtained on the second day for each subject was applied to the fourth day of collection. The procedures adopted to obtain the maximum load of 10 repetitions were the same on both days and are described below: he was allowed a maximum of 5 attempts to reach the load to 10 MR with the range of 5 minutes between attempts, the load used the first attempt was determined by the subject (subjective) based on its experience in training, increasing the load between the trials was at least 1 kg, the subjects were instructed to perform up to 10 repetitions per attempt even if the load would more And is considered a valid attempt in which the volunteer has done 10 repetitions with the maximum load possible, the failure concentric or eccentric, before the tenth repetition to be reached, the attempt has been discarded, not to limit the generation of power to speed implementation was not standardized among the subjects. (Brown and Weir, 2001).

Aiming to establish a similar pattern of movement between the volunteers, the horizontal supine exercise was characterized as follows: initially the subject remained lying bench press position in a bank with support for horizontal bar Olympic-half (12 kg). The width of grip was at the discretion of the subject. In the downward phase, from the initial position the bar was driven vertically in the downward direction to contact the chest, performing horizontal abduction of shoulder and elbow flexion, and the upswing, the return to the starting position by performing horizontal adduction of shoulders and extension of elbows.

The electromyographic signal was acquired through the equipment EMG 1000 (Lynx Inc®), composed of an amplifier, 8 channel power (with four auxiliary channels) for pre-electrodes liabilities. Such equipment has 10V, and that this study wastracks programmable input of the converter up to 5V, with rate of common mode rejection ofused > 100 dB at 60 Hz. The rate of acquisition in each channel was 1 kHz. The EMG 1000 has a maximum rate of acquisition of 4 kHz per channel to communicate with PC using Ethernet network. It also has a power supply with input from 90 to 240 Vac or 12 Vdc. In addition to A / D converter model AC 1160, 16 channels, 16 digital inputs TTL (transistor-transistor-logic) and 16 TTL outputs, with two entries to counter up / down. The electrodes used in this study were passive electrodes with two plates of silver positioned at 10 mm distance of one another. The electrodes were placed between the engine and point distal tendon of each muscle studied by following the direction of the muscle fibers of these (Hermens et al, 2000). The location of the engine point was made through anatomical points informed by a standard gauge, but instead of fixing the place suffered trichotomy and cleaning with alcohol. The muscles selected were the pectoralis major (PM), anterior deltoid (DA), triceps brachii head long (TBCL) and rectus abdominal (RA).

For the evaluation of kinematic markers spherical polystyrene (2.5 cm diameter) covered with reflective tape were placed on anatomical points of the upper limbs: acromion, lateral epicondyle of the humerus, the midpoint between the ulnar styloid and the radio. Data were collected by a video camera, 30 HZ (SONY ®, Sao Paulo, Sao Paulo, Brazil) placed in the transverse plane of the individual during the year, after the images were analyzed in the Vicon Motion Analysis System (Vicon Corporation , Los Angeles, CA. USA). The analysis of the angular variations were performed only in the concentric phase, being established by the difference in the segment for the arm and forearm, with the lowest starting position angle and end the biggest angle of the movement.

For the collection of blood lactate, there were punctures in the distal part of the index finger of right hand with the unit Accu-Chek ® softclix ®, was held before sterilization with alcohol, the evaluator with disposable gloves for procedures. The blood samples were collected during the state of rest and at the end of the range (2 ') in each series. After the punch, the droplets of blood were placed on the tapes WB lactate Cobas ® and inserted into lactimeter Accutrend ® for consideration. There was a pattern to determine the lactate threshold, however, the rate was determined baseline (rest) between the same: 2.0 to 2.5 mmol / .

All data were described by mean and standard deviation. A test of the Shapiro-Wilk normality was applied, noting that the data showed normal distribution. Thus, the analysis between the variability of the magnitude articulate between different replicates, as well as for the various series was performed by a T-student test for paired measures. For the analysis of variance between the muscles used in the various series was one-way ANOVA and post hoc Scheffe of the same was applied to compare the blood lactate levels in different experimental situations. All tests used a significance level of $p < 0.05$, being treated in SPSS for Windows 14.0.

### RESULTS

The values of displacement articulate the dominant side (right) of the subjects showed no significant changes among those repetitions and not between set, Figure 1.
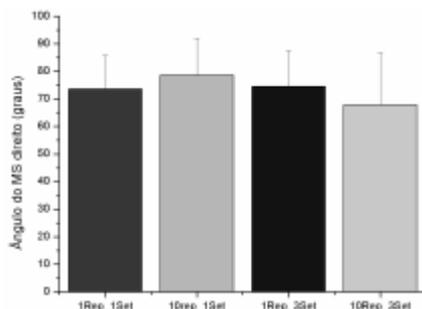


Figure 1 - Mean and standard deviation to the articular displacement of the upper limb during the year supine horizontal.

The same can be observed for the behavior of electromyographic RMS value in muscles PM, DA, TBCL and RA, table 1.

Table 1 - Mean and standard deviation for maximum muscular activity (RMS-mVolts) during the three rounds of implementation of the bench press.

| Mÿsculos | 1 sÿrie | 2 sÿrie | 3 sÿrie |
|----------|---------|---------|---------|
| PM | 2,006ÿ0,41 | 2,122ÿ0,31 | 2,212ÿ0,34 |
| DA | 2,722ÿ0,52 | 2,856ÿ0,60 | 2,892ÿ0,64 |
| TBCL | 2,356ÿ0,37 | 2,16ÿ0,65 | 2,184ÿ0,66 |
| RA | 0,316ÿ0,13 | 0,38ÿ0,09 | 0,426ÿ0,13 |

However, the level of lactate observed between series executed in relation to the rest showed significant changes, especially when compared all series in relation to the rest and the second and third rounds on the first. Differences between the second and third were not significant, Figure 2.
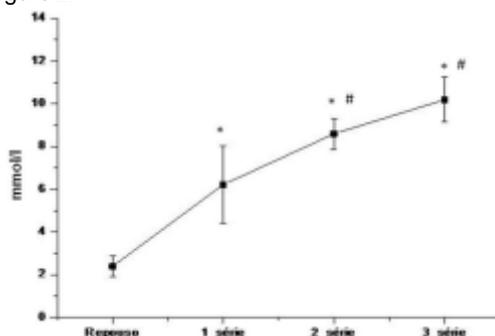


Figure 2-average values and spread to the concentration of lactate in the exercise supine horizontal in the four periods of collection, where (*) shows significant differences in relation to the rest period and (#) significant differences in relation to the first series ($p < 0.05$).

### DISCUSSION

According to the positioning of the American College of Sports Medicine (ACSM, 2002) compared to endurance training for intermediate and advanced practitioners, as there is sufficient intervals between 2 to 3 minutes for multi-joint exercises, and for single-joint exercises between 1 and 2 minutes. However, this issue is a little exploited, can be attributed mainly to muscle fatigue as a limiting factor for conducting exercises with short interval of recovery, due to the fact that such evidence is based on studies related to the acute effects of training.

Fleck and Kraemer (1999) demonstrated the influence that periods of recovery have in determining the stress of training and the total cargo that can be used. These intervals between series and exercises influence on issues such as the degree of recovery of energy ATP-CP, the concentration of blood lactate, which may influence factors such as fatigue and anxiety. Short periods of rest (1 minute or less) have serious psychological consequences (possibly by greater effort, greater discomfort and increased metabolic processes thus greater production of lactate) that should be considered when planning a training.

Adding, periodic intervals minors are accompanied by considerable muscle discomfort due to vascular occlusion, consequently higher production of lactate (TESH, LARSON, 1982) and, significantly reducing the production of power ( W I L A R D S O N ,                                          B U R K E T T ,                                          2 0 0 5 ) . For any reduction in blood lactate after completion of training of comprehensive strength, must be used ranges from 4 to 10 minutes, less time can cause a gradual increase in the concentration of hydrogen ions (H +), reducing the intracellular pH,

resulting in muscle fatigue (HULTMAN, SJOHOLM, 1986; JONES, 1990).

Our study used the fixed interval of 2 minutes between sets, showing reduction in the number of repetitions for some individuals. Thus to agree with the studies mentioned above, the component fatigue may be related to the results obtained in relation to the increased concentration of blood lactate, which compared the three series held in relation to the rest showed significant results, and compared the results of the second and third grades for the first held. But when analyzed the displacement articulate and behavior to the muscles electromyographic PM, DA, TBCL and RA, they showed no significant differences between the three rounds held so that this fact can assign the component fatigue.

Variations of the EMG signals during analysis of movements and show different variations as demonstrated Barbosa & Goncalves (2002), who when analyzing the same muscles, observed in this study, eight male volunteers, trained in weight lifting, with similar measures during antrompométricas Office development in the bank closed. What is less variability of the muscle occurs intrasujeito SMEs during the descent to the muscle and that TBL is at the stage of ascent. In the analysis intersujeitos, SMEs is the muscle that has the lowest CV during the descent and ascent. These results are indicative that the quantity and level of training of the subject may be factors in changes of behavior of the electromyographic signal.

Few studies emphasize the intervals between sessions, making it difficult to stipulate a period of range enough to ensure that individuals can recover and does not reduce the total number of repetitions.

### CONCLUSION

The results indicate that the articular displacement and the level of muscle activation are not changed by fixing the interval of rest between sessions, when it is 2 to 3 minutes. But changes in the level of lactate are indicative that the stress caused muscle during the time interval studied is great, but still need to be certain the mechanism of anabolic stress, as well as the possible overload generated in the structure articulate.

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### CHANGES IN PHYSIOLOGICALS AND BIOMECHANICS PARAMETERS DURING INTERVAL SET IN UPPER BODY EXERCISE FOR TRAINED INDIVIDUALS

ABSTRACT
The purpose of this study was to investigate the biomechanical changes (kinematics and articulate the level of maximum activity (root mean square-RMS)) and physiological (lactate) of the muscles involved in the exercise series in bench press intervals for trained individuals. The experimental group was composed of five volunteers (26.2 ± 5.6 years; 77.54 ± 9.56 kg, 168.1 ± 4.20 cm), all trained with more than two years of experience with the movement studied. As a criterion for inclusion, they could not show any injury myo-osteo-articular in the upper limb. The electromyographic signal was acquired through the equipment EMG 1000 (Lynx Inc.), composed of an amplifier, 8 channel power (with four auxiliary channels) for pre-electrodes liabilities. The assessment cinematic markers used spherical styrofoam (2.5 cm diameter) covered with reflective tape placed on anatomical points of the upper limbs. These data were obtained through a video camera, 30 HZ (SONY ®, Sao Paulo, Sao Paulo, Brazil), and subsequently analyzed in the Vicon Motion Analysis System (Vicon Corporation, Los Angeles, CA. USA). For the collection of blood lactate, there were punctures in the distal part of the index finger of right hand with the unit Accu-Chek ® softclix ®. After the punch, the droplets of blood were placed on the tapes WB lactate Cobas ® and inserted into lactimeter Accutrend ® for consideration. The analysis of variance showed no significant difference when comparing the results submitted to the displacement articulate and electromyographic analysis of the behavior, but compared to the levels of blood lactate there were significant variations between the measures collected, especially when compared all series in relation to rest, as well as for the second and third rounds on the first, getting no significant differences between the second and third series of exercises.
Key-words: kinematics, eletromiografia, bench press.

### CHANGEMENTS DANS LES PARAMÈTRES PHYSIOLOGIQUES ET DE LA BIOMÉCANIQUE DANS LES ANNÉES GAMME DE LA SÉRIE CONTRE L'ETAT POUR HAUTE RÉSISTANCE EN PERSONNES FORMÉES

RÉSUMÉ
Le but de cette étude était d'étudier la biomécanique des changements (cinématique et d'articuler le niveau d'activité maximale (root mean square-RMS)) et physiologiques (lactate) des muscles impliqués dans l'exercice série horizontale couchée dans des intervalles de personnes formées. Le groupe expérimental était composé de cinq volontaires (26,2 ± 5,6 ans; 77,54 ± 9,56 kg, 4,20 ± 168,1 cm), tous formés à plus de deux ans d'expérience à la circulation étudié. Comme un critère d'inclusion, ils ne

pouvaient pas montrer tout préjudice ostéo-myo-articulaire dans le membre supérieur. Le signal électromyographique a été acquis par le biais de l'équipement EMG 1000 (Lynx Inc), composé d'un amplificateur, 8 canaux de puissance (avec quatre canaux auxiliaires) pour les électrodes de pré-engagements. L'évaluation des marqueurs utilisés cinéma sphérique de styromousse (2,5 cm de diamètre) recouvert de bandes réfléchissantes placées sur les points anatomiques des membres supérieurs. Ces données ont été obtenues par une caméra vidéo, 30 Hz (Sony ®, Sao Paulo, Sao Paulo, Brésil), et ensuite analysés dans le Vicon Motion Analysis System (Vicon Corporation, Los Angeles, CA. Etats-Unis). Pour la collecte de sang de lactate, il y avait des perforations dans la partie distale de l'index de la main droite avec l'appareil Accu-Chek ® softclix ®. Après le coup de poing, les gouttelettes de sang ont été placés sur les bandes WB lactate Cobas ® et inséré dans lactimeter Accutrend ® pour examen. L'analyze de la variance n'a révélé aucune différence significative si l'on compare les résultats soumis à articuler le déplacement et électromyographique analyze du comportement, mais en comparaison avec les niveaux de lactate de sang, il y avait d'importantes variations entre les mesures recueillies, surtout en comparaison avec toutes les séries en ce qui concerne les repos, ainsi que pour les deuxième et troisième cycles sur la première, faire aucune différence significative entre la deuxième et la troisième série d'exercices.

Mots clés:  la cinématique, électromyographie, banc de presse.

## CAMBIOS EN PARÁMETROS FISIOLÓGICOS BIOMECÁNICA Y LA VARIEDAD EN LOS AÑOS EN LA SERIE CONTRA EL ESTADO DE ALTA RESISTENCIA EN INDIVIDUOS ENTRENADOS

RESUMEN

El objetivo de este estudio fue investigar los cambios biomecánicos (cinemática articular y el nivel de actividad máxima (media cuadrática-RMS) y fisiológicos (lactato) de los músculos que participan en la serie en el ejercicio en posición supina horizontal intervalos de personas capacitadas. El grupo experimental estaba compuesto por cinco voluntarios (26,2 ± 5,6 años; 77,54 ± 9,56 kg, 168,1 ± 4,20 cm), todos formados con más de dos años de experiencia con el movimiento estudiados. Como criterio para la inclusión, no podían mostrar ningún perjuicio Myo-osteo-articular en la extremidad superior. La señal electromiográfica fue adquirido a través del equipo de EMG 1000 (Lynx Inc), compuesto por un amplificador, 8 canales de energía (con cuatro canales auxiliares) para pre-electrodos pasivos. La evaluación de marcadores de cine esférico utilizado espuma de poliestireno (2,5 cm de diámetro) cubierto con cinta reflectante en puntos anatómicos de las extremidades superiores. Estos datos fueron obtenidos a través de una cámara de vídeo, 30 Hz (SONY ®, Sao Paulo, Sao Paulo, Brasil), y posteriormente analizadas en el Movimiento Vicon Sistema de Análisis (Vicon Corporation, Los Angeles, CA. EE.UU.). Para la recogida de lactato en sangre, hubo pinchazos en la parte distal del dedo índice de mano derecha con la unidad de Accu-Chek ® softclix ®. Después de que el ponche, las gotas de sangre fueron colocados en las cintas WB lactato Cobas ®, y se incluirán en lactimeter Accutrend ® para su examen. El análisis de varianza no mostró diferencias significativas al comparar los resultados presentados para el desplazamiento articular y electromiográfica análisis de la conducta, pero si se compara con los niveles de lactato en sangre hay variaciones significativas entre las medidas recogidas, sobre todo cuando se comparan todas las series en relación con de descanso, así como para la segunda y tercera rondas en la primera, no obteniendo diferencias significativas entre la segunda y la tercera serie de ejercicios.

Palabras clave: f la cinemática, electromiografía, banco de prensa.

## ALTERAÇÕES NOS PARÂMETROS BIOMECÂNICOS E FISIOLÓGICOS DURANTE SÉRIES INTERVALADAS EM EXERCÍCIOS CONTRA-RESISTÊNCIA PARA MEMBRO SUPERIOR EM INDIVÍDUOS TREINADOS

RESUMO

O objetivo do referido trabalho foi investigar as alterações biomecânicas (cinemática articular e do nível de atividade máxima (root mean square-RMS)) e fisiológicas (lactato) dos músculos envolvidos no exercício supino horizontal em séries intervaladas para indivíduos treinados. O grupo experimental foi composto por cinco voluntários (26,2 ± 5,6 anos; 77,54 ± 9,56 Kg; 168,1 ± 4,20 cm), sendo todos treinados com mais de dois anos de experiência com o movimento estudado. Como critério de inclusão, os mesmos não poderiam apresentar qualquer lesão osteo-mio-articular no membro superior. O sinal eletromiográfico foi adquirido por intermédio do equipamento EMG 1000 (*Lynx Inc.),* composto por um amplificador diferencial de 8 canais centrais (com quatro canais auxiliares) para eletrodos passivos pré-amplificados. A avaliação cinemática utilizou marcadores esféricos de isopor (2,5 cm diâmetro) cobertos com fitas reflexivas posicionadas nos pontos anatômicos dos membros superiores. Esses dados foram obtidos através de uma câmera de vídeo de 30 HZ (SONY®, São Paulo, São Paulo, Brazil), e posteriormente analisados no sistema Vicon Motion Analysis System (Vicon Corporation, Los Angeles, CA. USA). Para a coleta de lactato sanguíneo, foram realizadas punções na parte distal do dedo indicador da mão direita com o aparelho Accu-Chek® Softclix®. Após a punção, as gotículas de sangue foram colocadas nas fitas BM Lactate Cobas® e inseridas no lactímetro Accutrend® para serem analisadas. A análise de variância não apresentou diferença significativa quando da comparação entre os resultados apresentados para o deslocamento articular e análise do comportamento eletromiográfico, mas quando comparados aos níveis de lactato sanguíneo houveram variações significativas entre as medidas coletadas, principalmente quando comparada todas as séries em relação ao repouso, bem como para segunda e terceira séries em relação a primeira, não obtendo diferenças significativas entre a segunda e terceira série de exercícios.

Palavra-chaves: cinemática, eletromiografia, supino hirizontal.