127 - ANALYSIS OF THE PERFORMANCE OF VERTICAL JUMPS AMONG PLAYERS OF VOLLEYBALL, HANDBALL AND FUTSAL

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1. INTRODUCTION

The capacity to jump is a motive quality quite requested in practice sporting and it represents an important factor for the revenue in several modalities, in individual sports and in collective games. In the volleyball, for instance, they are accomplished on an average between 170 and 190 jumps by set. (KOLLATH, 1996), in the basketball each player does between 2 and 3 vertical jumps with maximum effort for effective minute of the game that corresponds a great number between 80 and 100 jumps during a game (HAGEDORN et al., 1996). This great number of jumps implicates in a great preparation of athletes that are exposed to this great load of incentives This can be obtained through different tests of jumps with which the training can be evaluated and be directed. Some studies come being carried through in the attempt to explain the 0 variable that determine the effectiveness of this action, since, each time more, the performance of the jumps of the athletes is a decisive factor in the final result (HASSON et al., 2004; VILLAREAL, 2005). The system of evaluation from the vertical impulse is composed by the jumps without countermovement, "squat Jump" (SJ), jump with countermovement, "countermovement Jump" (CMJ) and jumps in depth of different heights, "drop Jump" (DJ). The performance in the SJ is a criterion for the concentric force and through the relation it enters the heights in SJ and CMJ, is possible to evaluate the elastic capacity of complex tendon-muscle (VELÉZ, 1992; UGRINOWITSCH and BARBANTE, 1998), as well as the exploitation of the "Principle of the Initial Force" (HOCHMUTH, 1982), according to this principle, the preparation movement is carried through the contrary direction to the main movement that cause, due to lockwire force, a bigger initial force at the moment of the direction inversion of the movement, that it is the beginning of the main phase. The DJ is a jump characterized by the form of muscle work in the Stretch-Shortening Cycle (SEE). In this jump, the individual "falls" of platforms with different daily determined heights. After that, the jump is executed keeping the time of inferior contact of 200 ms (SCHMIDTBLEICHER, 1992). Beyond the diagnostic results possessing a great importance for the direction of the training, also widely they are used to detect of sport talents (BECK & BÖS, 1995). Therefore, the objective of this work is to analyze the capacity of jumping from techniques SJ and CMJ in the collective sports of squares volleyball, Handball and futsal.

2. MATERIALS and METHODS

34 males accomplished this study, being 11 volleyball athletes, 11 from handball and 12 from futsal. The characterization of the sample can be visualized in TAB 1.

TABLE 1
Descriptive Statistics for characterization of the sample

Modality	N	Age	Stature	Body weight
Volleyball	11	18,7±0,6 (years)	185,3±76 (cm)	85,7±9,8 (kg)
Handball	11	19,2±1,5 (years)	182,9±4,7 (cm)	72,6±6,1 (kg)
Futsal	12	19,2±0,4 (years)	175,5±5,2 (cm)	68,4±4,9 (kg)

2.2 Variable and method of measurement

The biomechanics criterion for the evaluation of the impulse is the rise of (?h), that it was determined through the measurement of the time from the flight phase (t), using a plate by a contact to a computer. When the heights of the Center of Gravity (CG) in the take-off and landing are equal, the maximum height of the rise of the CG can be determined through the following equation (g=9.81 ms-2): h = ½ g t2. The precision of the time determination is 0.001s that it results in a precision of the determination of the height.

2.3 Statistical Method

As criterion of three measurements of each athlete was used an average. For the verification of normality of the data the Komogorov-Smirnov test was used. The test was used to compare the difference between SJ and CMJ and each modality. A test of multiple comparison was carried through, to compare the averages of jumps SJ and CMJ among the modalities volleyball, handball and futsal. The level of significance was of p = 0.05.

2.4 Hypotheses

· There is not a difference between the results of the SJ and CMJ and the players from volleyball, handball and futsal.
· There is a difference between the results of SJ CMJ and the players from volleyball, handball and futsal.

3. RESULTS

In table 2 is demonstrated the averages of jumps SJ and CMJ comparison between the modality. The results show that difference exists between the jump techniques in the volleyball and Futsal modalities. For the Handball it did not have any difference.

TABLE 2
Comparison of the averages (test t) between techniques SJ and CMJ in each modality

Modalities	Squat Jump	Countemovement Jump	significance
Volleyball	33,9±4,9 (cm)	40,1±2,2 (cm)*	0,001
Handball	35,5±6,1 (cm)	35,4±6,6 (cm)	0,92
Futsal	32,6±2,6 (cm)	35,4±2,2 (cm)*	0,015

Table 3 shows the averages and shunting standard deviation of the performance of the jumps for the players of volleyball and handball. The averages of the jumps performances present significant difference (p<0,05) between the modalities only by the technique CMJ.

TABLE 3
Multiple Comparison of the performance of the slews between the modalities

Technique of jump	Modalities		
	Volleyball (VB)	Handball (HB)	Futsal (FS)
Squat Jump	33,9±4,9 (cm)	35,5±6,1 (cm)	32,6±2,6 (cm)
Countermovement Jump	40,1±2,2 (cm)*(b e c)	35,4±6,6 (cm)*(a)	35,4±2,2 (cm)*(a)

4. DISCUSSION

In sciences of sport, the first analyses of jumps had been carried through with the CMJ. Had the great affinity between the SJ and the CMJ, the method of evaluation of these jumps it is the same. In the sport the difference can be used enters the performance of CMJ and SJ, that is a criterion to evaluate the use of the daily pay-extension of the muscle and the biomechanic exploitation (coordination) of the "Initial Force", according to Hochmuth (1973). This criterion of evaluation of the jump is of most importance in the process of diagnosis evaluation and can be used in the prognostic evaluation. The results of the comparison of the performance between SJ and CMJ of each modality had inside shown that it had differences in voleyball and futsal. This difference indicates that these athletes use the principle of the "Initial Force", as well as the stretch shortening cycle. For Komi (2006) when a concentric action preceded an eccentric phase, there is a production of elastic potential energy that can be used in the concentric phase. This energy results in a stronger action and faster, making the athletes jump higher or dislocate with bigger speed. For Kubo et al. (1999) and Kurokawa et al. (2003) the storage of elastic energy of the elastic components of the muscles is related with the increase of the movement speed. The differences of the averages of the jumps between the modalities demonstrate that the players from volleyball jump more than from handball and the futsal, when used the CMJ. This can be explained by the fact of that in volleyball the jump is present in a great part of the inherent techniques to this disciplines porting (specific actions of the modality in question). However, it did not have significant differences by the SJ. This can be explained by the fact of this jump technique is not common by the studied modalities. Due to specific of volleyball, the training is come back toward the jumps (training of attack, training of blockade, service training in suspension). This can be another factor that takes the players from volleyball to jump more than the players from handball. In handball the athletes are more demanded by the execution of short and long displacements. The jumps are only carried through in the launchings and the blockades.

5 CONCLUSION

The results above presented can be concluded by the following form: The players from volleyball jump more than the players from handball and futsal in technique CMJ, demonstrating that significant difference between the three modalities. However, it did not have significant differences in the performance of jump SJ between the modalities. When compared the techniques of jump SJ and CMJ inside of each modality had significant differences for volleyball and futsal. However it did not have differences for handball.

BIBLIOGRAPHY

BECK, J., BÖS, K. *Normwerte motorischer Leistungsfähigkeit*. Köln: Sport & Strau, 1995.
BOSCO, C.; KOMI, P. Muscle elasticity in athletes. In: KOMI, P. (ed.): *Exercise and sport biology*. Human Kinetics Publ., Champaign 1982, p. 109-117.
GRECO, P., MENZEL, H-J., RODRIGUES, L.O.C., SAMULSKi, D., SZMUCHROWSKI, L. *Relatório científico dos Jogos da Juventude em Goiânia 1997*. Brasília, 1998.
HASSON, C. J.; DUGAN, E. L.; DOYLE, T. L.; HUMPHRIES, B.; NEWTON, R. U. Neuromechanical strategies employed to increase jump height during the initiation of the squat jump. *Journal of Electromyography and Kinesiology*, v. 14, n. 4, p. 515-521, 2004.
HAGEDORN, G. NIEDLISH, H. SCHIMDT, G. Das Baskettball-Handbuch. Reinbek: Rowolth Verlag, 1996.
HOCHMUTH, G. *Biomecanica de los movimientos deportivos*. Madrid: Ciencia Deporte. 1973.
KUBO, K.; KAWAKAMI, Y.; FUKUNAGA, T. Influence of elastic properties of tendon tructures on jump performance in humans. *Journal of Applied Physiology*, v. 87, n. 6, p. 2090-2096, 1999.
KUROKAWA, S.; FUKUNAGA, T.; NAGANO, A.; FUKASHIRO, S. Interaction between fascicles and tendinous structures during counter movement jumping investigated in vivo. *Journal of Applied Physiology*, v. 95, n. 6, p. 2306-2314, 2003.
KOLLATH, E. *Bewegungsanalyse in den Sportspielen*. Köln: Sport & Buch Strau, 1996.
MARTIN, D. Zum Belastungsproblem im Kinder- und Jugendtraining unter besonderer Berücksichtigung von Vielseitigkeit oder Frühspezialisierung. *Leistungssport*, v. 21, p.5-8, 1991.
SCHMIDTBLEICHER, D. Training of Power Events. In: KOMI, P. (ed.): *Strength and Power in Sport*. Oxford: Blackwell Scientific Publications, p. 381-395, 1992.
SCHMIDTBLEICHER, D. Maximalkraft und Bewegungsschnelligkeit. Limpert Verlag, Bad Homburg 1980.
UGRINOWITSCH, C.; BARBANTE, V. J. O ciclo de alongamento e encurtamento e a “performance” no salto vertical. Rev. paul. Educ. Fís., São Paulo, **12**(1): 85-94,. 1998.
VELEZ, M. El entrenamiento de fuerza para mejora el salto. *Apuntes de medicina del deporte*, XXIX, Leon, p. 139-244, 1992.
VILLAREAL, E. S. S. Variables determinantes en el salto vertical, Internet site address:<http://www.efdeportes.com/efd70/salto.htm>. Acesso em 15/03/2005.
WEINECK, J. *Manual do Treinamento Esportivo*. Editora Manole, São Paulo 1989.

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ANALYSIS OF THE PERFORMANCE OF VERTICAL JUMPS AMONG PLAYERS OF VOLLEYBALL, HANDBALL AND FUTSAL

ABSTRACT

The propose of this work is to compare the capacity to jump from the Squat Jump (SJ) and Countermovement Jump (CMJ) techniques in the collective sports of blocks volleyball, handball and futsal. The performance in the SJ is a criterion to

measure the concentric force and through the relation it enters the heights in the SJ and CMJ, is possible to evaluate the elastic capacity of the muscle, as well as the exploitation of the "Principle of the Initial Force", according to this principle, the preparation movement is carried through in the contrary direction to the main movement that cause, a bigger initial force at the moment of the inversion of the direction of the movement, that it is the beginning of the main phase. The sample of citizens was composed for 34 individuals of the masculine sex being 11 athletes of volleyball, 11 of handball and 12 of futsal. The results of the comparison of the income between SJ and CMJ of each modality had inside shown that it had differences in volleyball and futsal. This indicates that these athletes use the principle of the "Initial Force", as well as of the muscle coordination. The differences of the averages of the jumps between the modalities demonstrate that the players from volleyball jump more than from handball and the futsal, when used the CMJ. This can be explained by the fact that in volleyball the jump is present in a great part of the inherent techniques to this disciplines porting. However, it did not have significant differences for the SJ. This can be explained by the fact of this jump technique is not common for the studied modalities.

KEYWORDS: Vertical Jumps, volleyball, handball and futsal.

L'ANALYSE DE L'EXÉCUTION DE LA VERTICALE SAUTE PARMI DES JOUEURS DE VOLLEYBALL, DE HANDBALL ET DE FUTSAL

RESUMÉ

La proposition de ce travail doit comparer la capacité de sauter du saut de posture accroupie de techniques (SJ) et du saut de Countermovement (CMJ) dans les sports collectifs des places volleyball, handball et futsal. L'exécution dans le SJ est un critère pour mesurer la force concentrique et par la relation elle écrit les tailles dans le SJ et CMJ, est possible pour évaluer la capacité élastique du muscle, aussi bien que l'exploitation du "principe de la force initiale", selon ce principe, le mouvement de préparation est exécuté dans la direction contraire au mouvement principal qui causent, une plus grande force initiale à l'heure actuelle de l'inversion de la direction du mouvement, que c'est le début de la phase principale. Le groupe des citoyens s'est composé pour 34 individus du sexe masculin étant 11 athlètes de volleyball, de 11 de handball et de 12 de futsal. Les résultats de la comparaison du revenu entre SJ et CMJ de chaque modalité ont eu l'intérieur montré qu'il a eu des différences dans le volleyball et futsal. Ceci indique que ces athlètes emploient le principe "de la force initiale", aussi bien que de la coordination de muscle. Les différences des moyennes des sauts entre les modalités démontrent que les joueurs du volleyball sautent davantage que du handball et du futsal, une fois utilisé le CMJ. Ceci peut être expliqué par le fait de cela dans le volleyball que le saut est présent dans une grande partie des techniques inhérentes à cette mise en communication de disciplines. Cependant, il n'a pas eu des différences significatives pour le SJ. Ceci peut être expliqué par le fait de cette technique de saut pour ne pas être commun pour les modalités étudiées.

MOTS CLEF: Sauts verticaux, volleyball, handball et futsal.

EL ANÁLISIS DEL FUNCIONAMIENTO DE LA VERTICAL SALTA ENTRE JUGADORES DEL VOLEIBOL, DEL BALONMANO Y DE FUTSAL

RESUMEN

El objetivo de este trabajo es comparar la capacidad de saltar del salto de la posición en cuclillas de las técnicas Squat Jump (SJ) y del Countermovement Jump (CMJ) en los deportes colectivos de los cuadrados voleibol, balonmano y futsal. El funcionamiento en el SJ es un criterio para medir la fuerza concéntrica y con la relación incorpora las alturas al SJ y CMJ, es posible evaluar la capacidad elastica del musculo, así como la explotación “principio de la fuerza inicial” , según este principio, el movimiento de la preparación se lleva a través en la dirección contraria al movimiento principal que causa, una fuerza inicial más grande en el momento de la inversión de la dirección del movimiento, que es el principio de la fase principal. La muestra de ciudadanos fue compuesta para 34 individuos del sexo masculino que era 11 atletas del voleibol, 11 de balonmano y 12 de futsal. Los resultados de la comparación del rendimiento entre SJ y CMJ de cada modalidad tenían interior demostrado que tenía diferencias en voleibol y futsal. Esto indica que estos atletas utilizan el principio del " fuerza inicial", así como de la coordinación muscular. Las diferencias de los promedios de los saltos entre las modalidades demuestran que los jugadores del voleibol saltan más que de balonmano y del futsal, cuando está utilizado el CMJ. Esto se puede explicar por el hecho de eso en voleibol que el salto está presente en una mayor parte de las técnicas inherentes a este deporte hacia el lado de babor de las disciplinas. Sin embargo, no tenía diferencias significativas para el SJ. Esto se puede explicar por el hecho de esta técnica del salto para no ser común para las modalidades estudiadas.

PALABRAS CLAVE: Saltos verticales, voleibol, balonmano y futsal.

ANÁLISE DO RENDIMENTO DE SALTOS VERTICAIS ENTRE JOGADORES DE VOLEIBOL, HANDEBOL E FUTSAL

RESUMO

A proposta deste trabalho é comparar o rendimento dos saltos verticais a partir das técnicas Squat Jump SJ (salto sem contra movimento) e Countermovement Jump CMJ (salto com contra movimento) nos esportes coletivos de quadra voleibol, handebol e futsal. O desempenho no SJ é um critério para medir a força concêntrica e através da relação entre as alturas no SJ e CMJ, é possível avaliar a capacidade elástica da musculatura, bem como o aproveitamento do “Princípio da Força Inicial“, segundo este princípio, o movimento de preparação é realizado na direção contrária ao movimento principal que causa, devido à força de frenagem, uma força inicial maior no momento da inversão da direção do movimento, que é o início da fase principal. A amostra de sujeitos foi composta por 34 indivíduos do sexo masculino, sendo 11 atletas de voleibol, 11 de handebol e 12 de futsal. Os resultados da comparação do rendimento entre o SJ e CMJ dentro de cada modalidade mostraram que houve diferenças no voleibol e futsal. Isto indica que estes atletas utilizam o princípio da “Força Inicial”, bem como da coordenação intermuscular. As diferenças das médias dos saltos entre as modalidades demonstram que os jogadores de voleibol saltam mais que os de handebol e futsal, quando utilizado o CMJ. Isto pode ser explicado pelo fato de que no voleibol o salto está presente em uma grande parte das técnicas inerentes a esta disciplina desportiva (especificidade da modalidade). No entanto, não houve diferenças significativas para o SJ. Isto pode ser explicado pelo fato desta técnica de salto não ser comum para as modalidades estudadas.

PALAVRAS CHAVE: Saltos verticais, voleibol, handebol e futsal.