INTERCORRELATION BETWEEN SELECTED TESTS OF EXPLOSIVE POWER IN LOWER EXTREMITIES OF FEMALE VOLLEYBALL PLAYERS

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Abstract

The aim of this study was to verify intercorrelation between selected tests for measuring explosive power of lower extremities of cadet female volleyball players. The program was applied to a group of players at the age of 15 - 17. For measuring there were used standard motor tests: vertical jump with an approach (T1), standing vertical jump (T2), standing broad jump (T3) and countermovement jump (T4) on dynamometric Kistler plate Quattro jump Type 9290 AD. Correlation analyses were processed in program Statistica 9.0 CZ. Selective file reached following results (mean ± standard deviation): T1 = 55,8 ± 3,7 cm, T2 = 43,3 ± 4,4 cm, T3 = 205,0 ± 16,6 cm and T4 = 41,0 ± 4,2 cm. The empirical investigation revealed that selected tests are mutually highly or very highly dependent (r = 0,78 to 0,90). The lowest correlation (r = 0,78) showed a relationship between T1 test and T3 test. The highest correlation (r = 0,90) was found between T2 test and T4 test.

Introduction

Muscle strength is very important for most sport games at the present time. In volleyball, the level of explosive power is the most essential part of most player skills and markedly influences process of sport performance. Volleyball coaches develop explosive power through many methods applied in traning units. Therefore they design training units into periods of various amplitudes (Lehnert et al., 2009; Perič a Dovalil, 2010, Bompa and Haff, 2005).

A part of these plans are control tests because of the coaches´s notification, how successful they and their athletes are. There are several methods measuring or verifying the level of explosive power. We have chosen some of them and tried to find out, whether it is needed to do several or just a specific one, and then derive the result. Then we tried to find out which one is the most appropriate to use, and for coaches themselves.

1 The aim of our study

The aim of this study was to verify intercorrelation between selected tests for measuring explosive power in lower extremities at cadet female volleyball players.

2 Methods

2.1 Characteristics of selected sample

The program was applied to a group of female volleyball players at the age of 15 – 17. The body height and body weight were measured (see table 1).

Tab. 1 Sample characteristics

Characteristics	M	SD
Age (years)	15,8	1,29
Body height (cm)	175	7,6
Body weight (kg)	68,4	4,6

Note: M = mean, SD = standard deviation

Statistical data together with correlation analysis were processed in programme Statistica 9.0 CZ.

2.2 Characteristics of selected motor tests

T1 - Vertical jump with an approach

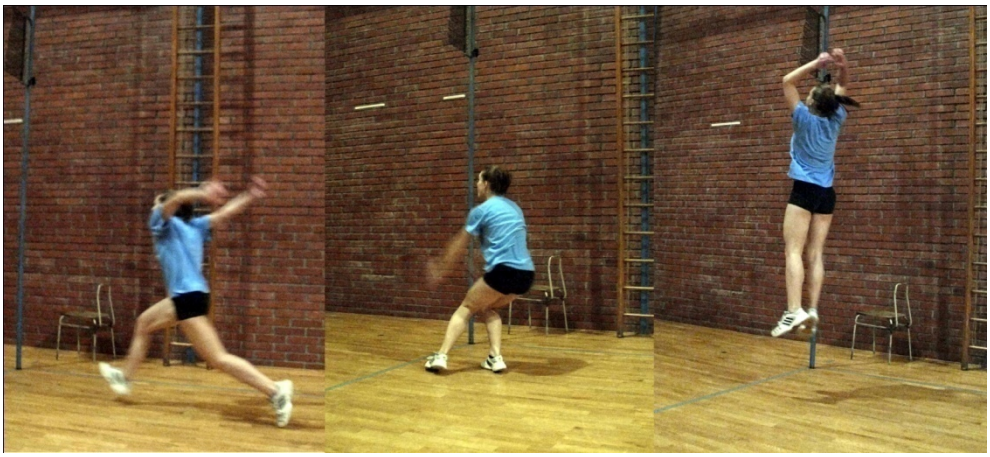

Fig. 1 Vertical jump with an approach technique

A proband assumes a relaxed, upstandig position with feet about shoulder-width apart. Arms are slightly flexed and held close to the body. Then he or she pushes off both feet simultaneously and extends through the hips to land on one foot followed with the other one. After that he explodes upward, reaching for a target or object (see fig. 1).

T2 - Standing vertical jump

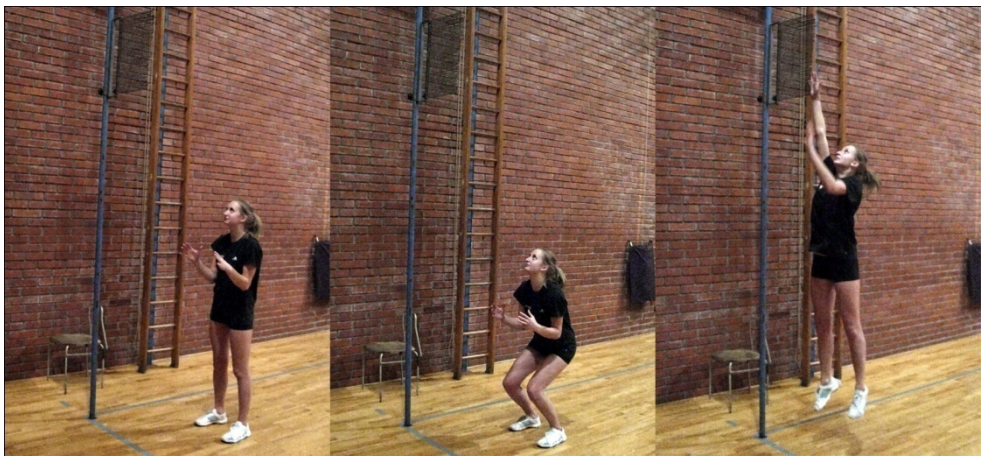

Fig. 2 Standing vertical jump technique

A proband takes an upright position with feet about shoulder-width apart and arms flexed holding them close to the body. On a signal, the proband squats slightly and explodes upward, reaching for a target or object (see fig. 2).

T3 - Standing broad jump

Fig. 3 Standing broad jump technique

A proband takes a relaxed, upstanding position with feet about shoulder-width apart. Arms are slightly flexed and holded close to the body. The proband bends one quarter- squat position, keeping chest up and back flat. He explodes directly out in front trying to reach as far as possible (see fig. 3)

T4 - Countermovement jump on Kistler Quattro Jump Type 9290AD (fig. 4)

Quattro Jump provides an objective measurement of force, power and jump height. This force plate measures the vertical jump force which is analyzed with the computer connected to system. It measures the vertical force during the jump and transmits it to the computer 500 times per second (Kistler, 2011).

Fig. 4 Kistler Quattro Jump Type 9290AD

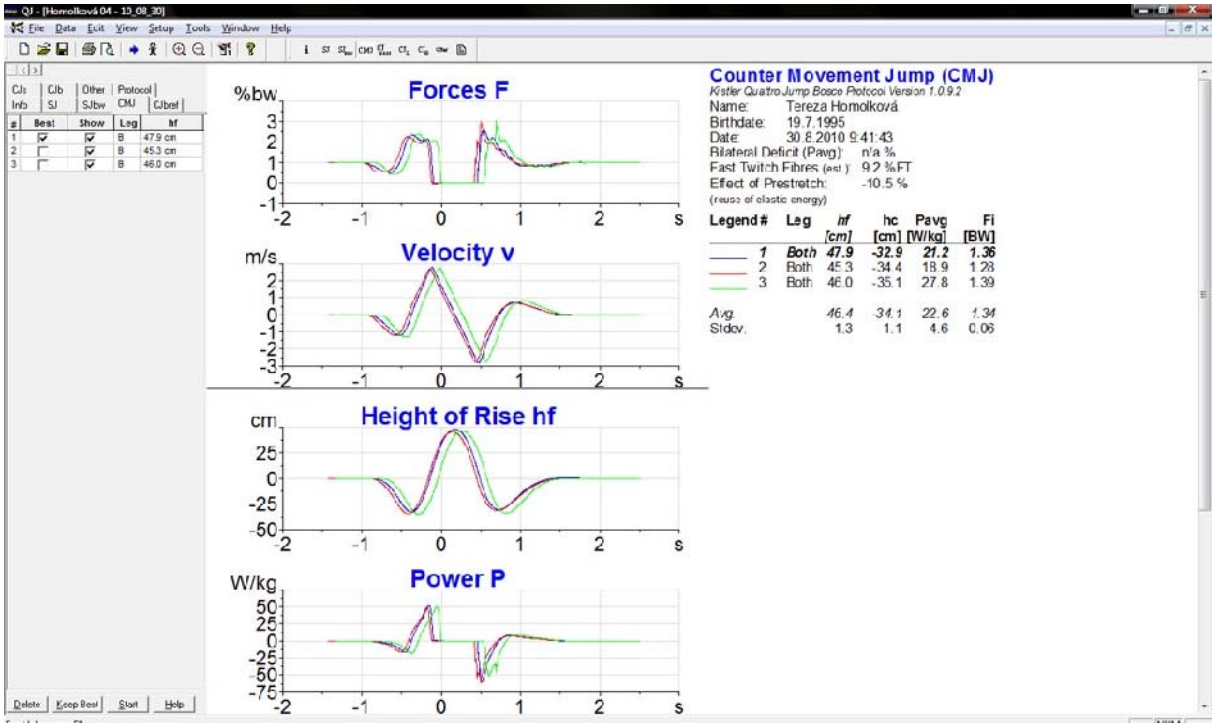

Fig. 5 Output information

Kistler plate gives us much more information. There is calculated acceleration „a“ (m/s^2), velocity „v“ (m/s), jump height „s“ (cm) and power „P“ (W/kg) from vertical force „F“ (N). In our case the jump height is needed (see fig. 5.)

Fig. 6 Countermovement jump technique

The accurate move technique is demanded (see fig. 6). Properly performed countermovement jump must be done continuously in curves of performance. The athletes stand upright in socks or bare feet, as still as possible on the desk with hands on hips for a few seconds. Jump is starting with straight legs and performing a natural flexion before takeoff. The proband jumps as high as possible, and as fast as possible. After that he lands with normal flexion and stands still in neutral position.

3 Results and discusion

Tab. 2 Mean and standard deviation

Test	M	SD
T1 – Vertical jump with an approach	55,8	3,7
T2 – Standing vertical jump	43,3	4,4
T3 – Standing broad jump	205,0	16,6
T4 – Countermovement jump	41,0	4,2
Body weight	68,8	7,6
Body height	174,6	4,6

Selective sample reached following results (mean ± standard deviation): vertical jump with an approach 55,8 ± 3,7 cm, standing vertical jump 43,3 ± 4,4 cm, standing broad jump 205,0 ± 16,6 cm and countermovement jump 41,0 ± 4,2 cm (see tab. 2). For example results of standing broad jump is in accordance with Měkota and Kovář (1995) above the average of the population at the age of 16 which ranges from 193 to 212 cm. Results of standing vertical jump and vertical jump with an approach are in accoradance Zháněl and Lehnert (2003) also above the average of sport schools pupils at the age of 16. Their performance in average is 45,2 (T1) and 40,4 (T2).

Tab. 3 Multitest correlation

Test	T1	T2	T3	T4
T1 – Vertical jump with an approach				
T2 – Standing vertical jump	0,86			
T3 – Standing broad jump	0,78	0,86		
T4 – Countermovement jump	0,85	0,90	0,87	
Body weight	-0,25	-0,17	-0,40	-0,17
Body height	-0,27	-0,23	-0,18	-0,26

The empirical investigation revealed that the selected tests are in accordance with Chráska (2007) mutually highly or very highly dependent (r = 0,78 to 0,90). The lowest correlation (r = 0,78) showed a relationship between vertical jump with an approach test and standing broad jump test. This is probably caused by a greater prestretch load in calf muscles. The highest correlation (r = 0,90) was found between standing vertical jump test and countermovement jump test. This is because of a similar technique the locomotor task performance (see tab. 3).

In accordance with Měkota and Kovář (1995) we also found out that correlation of selected tests with body weight and height confirm the opinion that subjects affect the test score to a small degree. Coefficients range from – 0,17 to 0,40.

Based on preceding results, we can affirm that if a proband has a significant result in one test, he or she will alsohave significant results in the following test measuring explosive power of lower extremities. Nevertheless, Kistler plate gives us much more information in contrast to motor tests, such as power, velocity and acceleration, as you can see in figure 12, so it provides more detailed information to the coaches. On the other hand, the probands do not have immediate feedback of their performance.

Conclusion

There is an interesting establishment due to the coaching practice that the volunteers showed a better approach to the implementation of selected motor tests, because of receiving immediate feedback of their performance in comparison with measurement on Kistler plate. The general validity of our findings is necessary to verify on larger examples.

Literature

[1] BOMPA, T.; HAFF, G.: *Periodization – Theory and methodology of training*. Human Kinetics, Champaign, IL, 2009. ISBN 0-7360-8547-5

[2] CHRÁSKA, M.: *Metody pedagogického výzkumu. Základy kvantitativního výzkumu.* Grada, Praha, 2007. ISBN 978-80-247-1369-4

[3] LEHNERT M.; LAMROVÁ, I.; ELFMARK, M.: *Changes in speed and strength in female volleyball players during and after a plyometric training program.* Acta Universitatis Palckianae Olomucensis. Gymnica, 39 (1), 59 – 65.

[4] MĚKOTA, K., KOVÁŘ, R.: *UNIFITTEST (6-60) Tests and Norms of Motor Performance and Physical Fitness in Qout and in Adult Age.* Palacký University, Olomouc, 1995. ISBN 80-7067-581-0

[5] PERIČ, T., DOVALIL, J.: *Sportovní trénink*. Grada publishing, a.s., Praha, 2010. ISBN 978-80-247-2118-7

[6] *KISTLER – measure, analyze, inovate*. [online]. World Wide Web cit. [2011-01-15]. Dostupný z WWW: <http://www.kistler.com/cz_cz-cz/Kistler CountryHome_KCS>.

[7] ZHÁNĚL, J., LEHNERT, M.: *Analýza výsledků testování motorických předpokladů žáků a žákyň sportovních tříd v roce 2003*. Zpravodaj Českého volejbalového svazu, 2004, 9, 19-20, 25 - 26.

INTERKORELACE VYBRANÝCH TESTŮ EXPLOZIVNĚ SILOVÝCH SCHOPNOSTÍ DOLNÍCH KONČETIN U HRÁČEK VOLEJBALU

Cílem práce bylo ověřit interkorelaci vybraných testů explozivně silových schopností dolních končetin u hráček volejbalu kadetského věku. Testovaný soubor tvořilo 17 hráček volejbalu na výkonnostní úrovni ve věku 15–17 let. K měření byly použity standardizované motorické testy: dosah jednoruč výskokem po smečařském rozběhu (T1), dosah jednoruč výskokem z místa (T2), skok daleký odrazem snožmo (T3) a test countermovement jump (T4) na dynamometrické desce typu Kistler Quattro Jump Type 9290AD. Korelační analýza byla zpracována v programu Statistica 9.0. Výběrový soubor dosáhl v jednotlivých testech následující výsledky (aritmetický průměr ± směrodatná odchylka): T1 55,8 ± 3,7 cm; T2 43,3 ± 4,4 cm; T3 205,0 ± 16,6 cm a T4 41,0 ± 4,2 cm. V rámci empirického šetření bylo zjištěno, že vybrané testy jsou vzájemně vysoce až velmi vysoce závislé (r = 0,78 až 0,90). Nejnižší závislost (r = 0,78) vykazoval vztah testu T1 k testu T3, nejvyšší korelace (r = 0,90) byla zjištěna mezi testem T2 a T4.

AUSGEWÄHLTE TESTS ZUR KORRELATION DER EXPLOSIVKRAFT UND DER SPRUNGKRAFT DER UNTEREN EXTREMITÄTEN BEI VOLLEYBALLSPIELERINNEN

Ziel dieser Studie war es, die Korrelation der ausgewählten Tests zur Messung der Explosivkraft und der Sprungkraft der unteren Extremitäten bei Volleyballspielerinnen im Jugendalter zu überprüfen. Das Testkollektiv bildeten 17 Volleyballspielerinnen im Alter zwischen 15 und 17 Jahren. Zur Messung wurden standardisierte motorische Tests genutzt: Reichweite eines vertikalen Sprungs nach einem linearen Anlauf (T1), Reichweite eines vertikalen Sprungs auf der Stelle (T2), Weitsprung mit einem beidbeinigem Absprung (T3) und der Test des „countermovement jump“ (T4) auf der Kraftmessplattform vom Typ Kistler Quattro Jump Type 9290AD. Die Korrelationsanalyse wurde in der Programmstatistik 9.0 erarbeitet. Die ausgewählte Mannschaft erreichte im Einzelnen folgende Ergebnisse (arithmetischer Mittelwert ± Standardabweichung): T1 55,8 ± 3,7 cm; T2 43,3 ± 4,4 cm; T3 205,0 ± 16,6 cm a T4 41,0 ± 4,2 cm. Im Rahmen der empirischen Untersuchung wurde festgestellt, dass die ausgewählten Tests in einer hohen bis sehr hohen Abhängigkeit zueinander stehen (r = 0,78 bis 0,90). Eine geringe Abhängigkeit (r = 0,78) zeigte das Verhältnis des Tests T1 zu T3, die höchste Korrelation (r = 0,90) wurde zwischen den Tests T2 und T4 festgestellt.

INTERKORELACJA WYBRANYCH TESTÓW SIŁY EKSPLOZYWNEJ KOŃCZYN DOLNYCH U SIATKAREK

Celem opracowania było sprawdzenie interkorelacji wybranych testów siły eksplozywnej kończyn dolnych siatkarek w kategorii kadetek. Badania prowadzono na grupie 17 siatkarek wyczynowych w wieku 15-17 lat. Do pomiarów zastosowano zestandaryzowane testy motoryczne: dosięg jednorącz w wyskoku po rozbiegu (T1), dosięg jednorącz w wyskoku z miejsca (T2), skok w dal z wybiciem z obu nóg jednocześnie (T3) i test countermovement jump (T4) na płycie dynamometrycznej typu Kistler Quattro Jump Type 9290AD. Analizę korelacyjną opracowano w programie Statistica 9.0. Badana grupa osiągnęła w poszczególnych testach poniższe wyniki (średnia arytmetyczna ± standardowe odchylenie): T1 55,8 ± 3,7 cm; T2 43,3 ± 4,4 cm; T3 205,0 ± 16,6 cm i T4 41,0 ± 4,2 cm. W ramach badań empirycznych stwierdzono, że wybrane testy są mocno lub bardzo mocno ze sobą skorelowane (r = 0,78 až 0,90). Najniższą korelację (r = 0,78) wykazał test T1 z testem T3, najwyższą korelację (r = 0,90) stwierdzono pomiędzy testem T2 i T4.