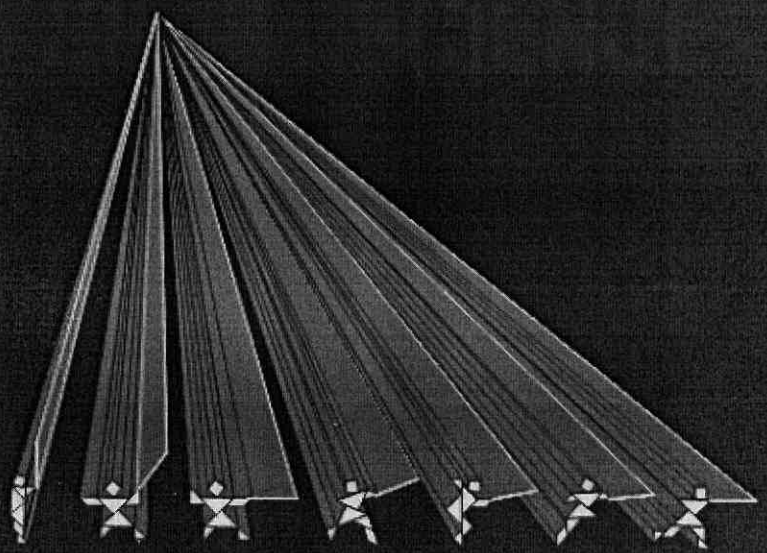
ISSN 1840-3662

SPORT SCIENCE

INTERNATIONAL SCIENTIFIC JOURNAL OF KINESIOLOGY



Vol.9, Issue 1; April, 2016.

CHANGES IN THE LEVEL OF EXPLOSIVE STRENGTH OF LOWER LIMBS IN SHOT PUT – A PILOT STUDY

NIKOLETA KUŠNÍROVÁ

Department of Physical Education and Sports, Faculty of Arts, Matej Bel University, Slovak Republic

Original scientific paper

Abstract
The aim of the pilot study was to analyse the level of explosive strength of the lower limbs of the shot put thrower at the preparatory period. The research was realized in preparatory period of annual training cycle 2013/2014. We used one parameter for evaluation: vertical jump – squat jump (SJ). The monitored proband is a representative of the Slovak Republic in the athletic discipline shot put in senior´s category. The squat jump (SJ) was measured by the device Myotest PRO (Myotest, Switzerland). Data were analysed by the statistical program R-Project. During the preparatory period we detected significant differences in SJ of the shot put thrower in individual measurements. The results were calculated according to the model of regression analysis.

Key words: mesocycles, preparatory period, squat jump

Introduction

Nowadays, trainers have the opportunity to innovate the training process through different devices. Very important factor in the athlete´s training process is to emphasize the stability of muscle hypertrophy and intramuscular coordination. If the athlete is heavy- duty we can expect positive transfer from his training to his performance it means that we can detect improvement in the performance (Wilson et al., 1993; Young, 1993; Zatsiorsky, 1995; Wilson et al. 1996; Baker, 2000; Young, 2001; Sweet et al., 2003). Zatsiorsky et al. (1981) presented that the athletic performance in the athletic discipline shot put depends mostly on the production of muscle strength. The authors Wilson et al. (1993); Foster (1998); Stone et al. (2003); Stone et al. (2004) realized the research in which they focused on fitness programs in athletics. They stated that the systematic application of strength exercises could be helpful for development of maximal strength of lower limbs. Many authors (Dapena, 1989; Foster et al., 2001; Kawamori- Haff, 2004) stated that muscle strength is considered as the factor which influence the sports performance the most it is also inevitable and very important element in athletic throws. That is why it is important to improve it in the athletic discipline like the shot put (Cook, 2006). Gassner (1994) recommended that the trainers should innovate the training process by using of optimal techniques and movement patterns which develop the strength of the lower limbs which is very specific for athletic throws. The authors recommended that the athletes to develop their neuromuscular factors because it develop their physical skills and abilities. Some tests in the shot put are specially focused and oriented on the detection of the level explosive strength of the lower limbs. Vanderka (2013) presented that the squat jump is one of the best diagnostic test for evaluation of the explosive strength of the lower limbs.

Material & methods

Characteristics of the proband
The experimental ensemble consisted of proband (n=1, age= 24, high= 195.6 cm, weight= 116 kg) who is a representative of the Slovak Republic in the shot put of the senior´s category. He ended his studies at Department of Physical Education and Sports at Matej Bel University in Banská Bystrica, Slovak Republic. The proband was born in 1991. He has been interested in athletics for eight years and he has been practicing the shot put for six years. He still participates in international competitions (World Championship, European Championship). The proband achieved 20th position in The European Athletics U 23 Championships in Tampere and he achieved 5th position in European Team Championshipin Riga. He is a multiple champion of Slovakia in shot put a he´s personal best is 18.25 m in shot put.

Organizing
The research was realized during the preparatory period. The preparatory period lasted from 4 November 2013 to 28 January, 2014. Intraindividual monitoring was divided into three mesocycles. Each mesocycle consisted of 4 week´s microcycle. The research was realized in military sport centre Dukla Banská Bystrica in the sport hall. During the preparatory period, we examined proband´s changes in the level of explosive strength of lower limbs through the test – squat jump. The proband was tested each Monday once a week during the whole preparatory period at 3:30 PM.

Measuring procedure
The explosive strength of lower limbs was measured by the test: squat jump through the device Myotest PRO (Myotest, Switzerland). The proband performed 2 maximum squat jump (SJ). The result of measurement was the height of squat jumps in cm with accuracy of 0.1 cm.

The test was performed after the warm up. The proband was acquainted with the right realization of the squat jump and he realized training tests before the measurements.

Data Analyses

In present study we used model of regression analysis. We tried to express the best curve which presented a general trend of the data. We used a line chart to express the graphical representation of regression models. We present basic descriptive characteristics, characteristics of central tendency and dispersion characteristics: arithmetic mean (x), standard deviation (s), the minimum measured values (Min) and maximum measured values (max), the regression equation, (the value of R^2, L) and 95% confidence intervals of the means. The statistical significance of regression is assessed on a significance level of 0.1 the normality is assessed on significance level of 0.05. We used the statistical software R-project for statistical evaluation of measured data. We used also interactive diagram for better visualization.

Results

We detected significant differences from the statistics´ point of view in the test of maximum squat jump (SJ). The significant differences were detected in individual measurements of the proband. The nonlinear regression model with an exponential function is the best model how to estimate the measured data. The significance of this model is at the level of 0.05 while the data are enough estimated by the model (R^2 = 0.4252). The regression model of measured individual data of the height of SJ are statistically significant on the level of 0.05 (figure 1). The thick line represents exponential curves that estimate input data and we also present regulation of the exponential function. The dashed lines around are the low and the upper boundary lines of 95 % confidence interval for the regression curve. The diagram compares the height of the squat jump in mesocycles.

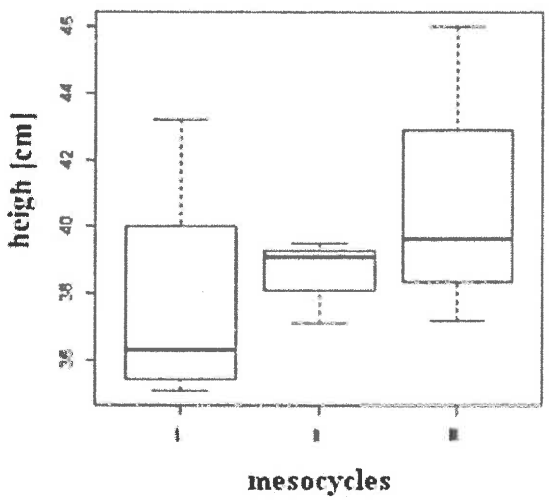


Figure 1 Comparison the height of the vertical squat jump (SJ)

The mean value of the individual mesocycles has an increasing and growing tendency. The variances in mesocycles are very different. The smallest variability of the squat jump´s values was detected in the 2nd mesocycle. We can monitor oscillating development of the squat jump´s height according to measured values. In the individual mesocycles we observed increasing and growing development. The lowest value (35.1 cm) was detected during the third microcycle, while the highest value (46.0 cm) was detected during the last (11^{th}) microcycle what is evaluated as very positive fact. The performance increased because of the approaching of the racing period (Figure 2).

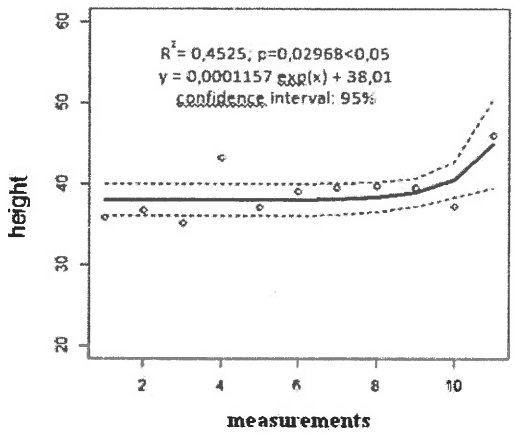


Figure 2 The regression model for the height of the vertical squat jump (SJ)

Discussion

The study presents that the proband showed significant better performance by the impact of training load and adaptation of the organism to the training load in the squat jump test. The training process which proband absolved during the preparatory period was efficient in terms of training´s effectiveness. We detected statistical and significant changes in squat jump test. We examined significant differences between the height of the jumps in individual measurements on the level of 0.05 while the data are enough estimated by the model (R^2 = 0.4252). Vanderka (2013) presented that the difference between realized jump from isometric half squat was always on the level of 0.01 and higher significant level. They detected significant higher values ($p < 0.05$) from isometric half squat (difference 99 W, about 10 %) and even higher in the countermovement jump test (164 W, about 16 %, $p < 0.01$) when comparing with the jumps from sitting position. Zemková, Hamar (2004) did not detected any significant differences in the heights when examining the jumps from the half squat without supplement load (the height of the jump from static position and the height of the countermovement jump). . Students achieved 37.7 cm vs. 39.5 cm; volleyball players 43.8 cm vs 45.9 cm (Zemková – Hamar, 2004). Vančová et al. (2015) compared the relationship between the chronotype and the countermovement jump.

They did not detected any significant difference ($p > 0,05$) in the morning/ evening performance in the test of countermovement jump. Baked (2006) presented that the largest growth could be achieved if we would train pulling components of the muscle. Fatouros et al. (2000) stated that the plyometric training programme and the strength training program have impact on vertical jump´s performance and their combination caused the biggest improvement in the vertical jump.

Conclusion

According to results we can state that in the parameter of the squat jump´s height we detected positive increase and growth in all measurements of the height which we connect with sufficient adaptation on the load. It is confirmed by the regression curve which presents the increasing tendency of the jump. The levels´ changes of the explosive strength of lower limbs were changed during the whole period in which we detected decreasing as well as increasing tendency.

The application of the strength's load cannot be always positive in the training process. According to the results we can state that the applied training load had the positive impact on proband´s performance because we detected increased level in monitored parameter when the racing period was approaching. The results pointed also on the importance of the reaction and respond on training load and its inevitable use in the training process. Thanks to the results 'comparing in three monitored parameters we detected that results could be influenced by:

- the repetition of the test - optimalization and effectiveness of the realization of the movement, improvement of the technique of movement´s realization
- the training's effect and the competition
- the effects of fatigue and level of fitness
- current disposition of the proband – concentration and maximum effort in test´s realization, positive psychological status during the testing

References

Baker, D. (1995). Selecting the appropriate exercises and loads for speed-strength development. *Strength and Conditioning Coach 3*: 8–15.

Baker, D. (2000). Overuse of Swiss ball training to develop core stability or improve sports performance. *Strength Cond Coach*. 8(2), 5-9.

Cook, M. (2006). Muscular power (Upper and lower body) and performance in the hammer throw. The University of Wisconsin-Whitewater.

Dapena, J. (1989). Influence of direction of the cable force and of the radius of the hammer path on speed fluctuations during hammer throwing. *Journal of Biomechanics. 22*, 6, 565-575.

Fatouros, I.G., Jamurtas, A.Z.,Leontsini, D., Taxildaris, K., Aggelousis, N., Kostopoulos, N., Buckenmeyer, P.(2000). Evaluation of plyometric exercise training, weight training, and their combination on vertical jumping performance and leg strength. *Journal of Strength and Conditioning Research 14*: 470–476.

Foster, C. (1998). Milwaukee Heart Institute, WI, USA. *Medicine and Science in Sports and Exercise* [1998,30 (7):1164-1168].

Foster, C., Florhaugh, J.A.,Franklin, J., Gottschall, Hrovatin, LA, Parker, S., Doleshla, P., Dodge, C. (2001). A new approach to monitoring exercise training. *Journal of Strength & Conditioning Research 15*:109–15.

Gassner, G.(1994).) The paradoxical nature of the hammer throw. *Track Coach 129*, 1994.

Kawamori, N. , Haff, G.G . (2004). The optimal training load for the development of muscular power. *Journal of Strength & Conditioning Research*

Stone, M.H.,Sanborn, K.,O'Bryant, H.S.,Hartman,M.,Stone, M.E., Proulx,C., Ward,B., Hruby,J.(2003). Maximum strength-power-performance relationship incollegiate throwers. *Journal of Strength and Conditioning Research 17*(4): 739-745.

Stone, M.H., Sandis, W.A., Carlock,J., Callan, S., Dickie, D. Daigle,K.,Cotton,J., Smith,S., Hartman,M.(2004). The importance of isometiric maximum strength and peak rate-of-force development in sprint cycling. *Journal of Strength and Conditioning Research 18*(4): 878-884, 2004

Sweet, TW., Foster, C., McGuigan, MR., Brice, G., Porcari, JP. (2003). Quantitation of resistance training using the session-RPE method, *Journal of Strength & Conditioning Research 17*:1.

Vanderka, M. (2013). *Silový tréning pre výkon.* Bratislava: FTVŠ UK.

Wilson, GJ., Newton, RU., Murphy, AJ., & Humphries , BJ. (1993). Centre For Human Movement Science and Sport Management, University of New England-Northern Rivers, *Nsw Australia Medicine and Science in Sports and Exercise* [1993, *25*(11), 1279-1286].

Wilson, GJ., Murphy, AJ., Walshe, A. (1996). The specificity of strength- training: the effect of posture. Eur J Appl Physiol. 1996;73:346-352.

Young, W. (1993). Training for speed/strength: Heavy versus light loads. NSCAJ 15(5):34-42.1993

Young, W. (2001). Speed, strength and power training. In: Pyke FS, ed.Better Coaching.Advanced Coaches Manual. 2nd ed. Champaign, Ill: Human Kinetics; 2001:123-136

Zatsiorsky, V.,Lanka, G., Shalmova, A. (1981). Biomechanical analysis of shot putting technique. *Exercise in Sports Science Review 99*,353-389.

Zatsiorsky, V. (1995). *Science and Practice of Strength Training*. Champaign, Ill: Human Kinetics;

Zemková,E., Hamar, D. (2004). Diferenciácia odrazových schopností pomocou doplnkovej záťaže. *Tel.Vých.Šport*,Vol. 14, No. 2, pp.19-20.

Vančová, D., Pivovarniček, P., Miňová, J., Bunc, V., Jančoková, J. 2015. Evaluation´s options of diurnal variation of physical performance of university students: a pilot study. In *Journal of Physical Education and Sport*. 2015. *15*(3), 598 – 602.

Received: March 02, 2016
Accepted: April 15, 2016
Correspondence to:
Nikoleta Kušnírová
Matej Bel University
Faculty of Arts
Department of Physical Education and Sports
974 01 Banská Bystrica, Tajovského 40, Slovakia
Tel.: 00421 48 446 7556,
E-mail: nikoleta.kusnirova@umb.sk

Acknowledgements
The project was supported by VEGA 1/1158/12 (Adaptation effect of training load in individual sports)