THE DEVELOPMENT OF THE EXPLOSIVE LEG STRENGTH OF THE FEMALE VOLLEYBALL TEAM DURING THE COMPETITION SEASON

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ABSTRACT
The author of the thesis addresses the development of the explosive leg strength of the female volleyball team during the competition season. The main method of collecting data was by means of various testing and the evaluation was carried out by means of logical, mathematical and statistical methods as well as a subject analysis. The coaching results refer to the advisability of implementing work-out exercises during competitions to enhance the performance of the players' explosive leg strength attained during the preliminary period. The results of this study have statistically confirmed the positive effect of explosive leg strength ($p < 0.05$). The author has concluded his thesis with several recommendations for practice.

Key words: *explosive leg strength, development of explosive leg strength, performance, volleyball*

INTRODUCTION

Explosive leg strength is defined as the individual ability of a person to manifest maximum strain in the shortest possible time-span. This ability depends on the development of strength and the speed of neuro-muscular exertion (Čillík, 1997; Korčok, Pupiš, 2006; Doležajová, Lednický, 2007; Grmanová, 2006).
Přidal and Zapletalová (2003) state the independent components of strength responsible for the development of explosive leg strength. Adding strength components to training in various combinations has been determined as necessary, e.g. maximum force, explosiveness, muscle activation speed and persistence (Pupišová, Pupiš, 2013).
One way to develop and enhance explosive leg strength is to adopt anaerobic-alactate training (Tonhauserová, 2012; Pupišová, 2013). The principal goal of a strength anaerobic work-out is to acquire speed as well as influence the maximum and explosive strength (Pupiš, & Broďáni, 2007). Speed-strength is obtained by the means of building explosive and maximum strength. Anaerobic-alactate strength training is an irreplaceable work-out method during the preliminary period, but it should be developed and implemented into an annual training cycle (Přidal – Zapletalová, 2003, Pivovarníček et al., 2013a). The main requirements necessary for the development of explosiveness - form of movement, psychological strain, conditions and form of realization - should be as approximate to competition conditions as possible (Pupiš, Štihec, & Broďáni, 2009). The effective usage of explosive leg strength requires the acquisition of certain jumping skills (Vanderka, 2006), by performing exercises of an explosive-jump character. However, the structure of the exercise should not be disrupted.
In practice, there are various methods used to acquire explosive leg strength (Sedláček, Lednický, 2010; Vavák, 2011, Pivovarníček, 2013b), e.g. plyometric, speed, the isokinetic-contrasting method. The implementation of individual exercises for the development of explosive leg strength is recommended 2 to 4 times a week (McNelly, & Sandlera, 2007; Přidal, & Zapletalová, 2010) while measurable changes take place after a 4 – 6 week-long cycle (Sedláček & Lednický, 2010). The development of leg explosiveness is influenced by the player's function (Lenhert, 2007; Vavák, 2011), because the forward line players jump more often than e.g. the liberos (defensive players). According to Zemková, Dzurenková and Pelikán (2002) it is possible to increase explosive leg strength by 20% - 25% by means of training. During the training process, a coach should necessarily take into consideration the distinct biological differences of the female body and therefore the strain on it should be increased at a slower rate. Naturally, the rapid escalation of training power cannot be expected as high as in the case of male volleyball players.

The physical conditioning before an actual performance concerning explosive leg strength is as important as long-term athletic conditioning (Pivovarníček, 2013c). The main goal of the warm-up exercise is to warm up prior to reaction training with an optimum increase in energy loss. As a matter of fact, the quality of explosive strength training depends to a great extent on neuro-regulative processes and it is also

influenced by the present state of the body (Bielik, Štulrajter, & Jánošdeák, 2003). The following authors pointed out the importance and timeliness of issues concerning explosive leg strength in sports activity (Pivovarniček et al. 2012, 2013; Pupiš et al. 2013; Švantner et al. 2013; Pivovarniček, & Pupiš, 2013; Pivovarniček et al. 2014). In their studies they dealt with the diagnostics and analysis of explosive leg strength concerning young elite Slovak football players.
The aim of the contribution is the development of explosive leg strength in a female volleyball team during the competition period.

METHOD

The experimental group consisted of 12 subjects aged 24 (±8 months) from the female extra league volleyball team, MŠK Žiar nad Hronom. The research took place over the period of March and April (6 weeks), at the end of the competition season. During this period players completed 30 training sessions, while 12 sessions focused on the development of explosive leg strength. All the training sessions had a duration of 120 minutes. In our research, we used a pedagogical experiment where the experimental factor was the implementation of a 6-week-long mesocycle during the competition period with an implementation of 2 training sessions a week focusing on the development of explosive leg strength. On Tuesdays the implemented exercises took place in a fitness centre and on Thursdays in a gymnasium.

Fitness centre (weight training) – Tuesdays
4 series, 8 repetitions / 1 min., 30 % personal max.

1) Ľ squats with anexercising weight on the back with lunge jumps
2) lunges
3) leg press

Gymnasium (athletics) – Thursdays

1) vaults over hurdles, 5 x 4 repetitions (at the start of the training session)
2) vertical jumps (40 cm in height), 4 x 8 repetitions (at the end of the training session)

In addition to this, players took part in 10 extra league matches over the period of March and April.

The principal method of research was the testing method. The test was measured by the means of the Myotest Pro device. In our research, we used the testing of speed and strength abilities. The testing took place in the gymnasium, where players have their training sessions. The initial test measuring took place at the beginning of the 6 week-long mesocycle and the final test measuring took place one week after its end. The players warmed up prior to the test under the examiner's supervision. The players were provided with a proper explanation and instructions on the testing process.

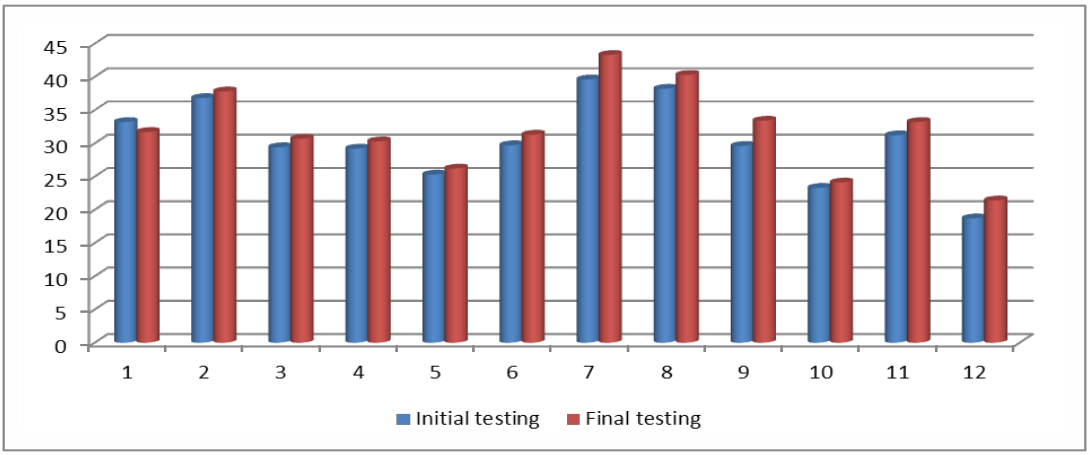
Explosive leg strength test (squat)

The subject is standing stride with arms akimbo, wearing a belt with the Myotest pro device. After acoustic signalization (the first beep) the subject performs a slow squat until the femoral muscle is at the same level with the mat and at the same time the angle between the femoral muscle and the tibia is at 90 degrees. The subject stays in this position and waits for the signal (the second beep) to perform a consecutive fast contraction (take-off jump), with legs in the standard anatomical position without bending them up to the abdomen. The subject squats a little only during the impact. The subject performs 5 attempts and the main criterion of the performance evaluation is the height in the vertical jump in cm, id est. the maximum vertical height achieved by the centre of the body. Within the subject framework and research evaluation we used the subject analysis. The statistically significant results of this study were evaluated by means of the Wilcoxon U – test for dependent samples and descriptive statistics. The statistical significance was attained by using the standard 5% significant level ($p < 0,05$).

RESULTS

Graph 1 represents the results of the initial and final testing of explosive leg strength tested on extra league volleyball players over a period of a 6 week-long conditioning work-out at the end of the competition season.

Graph 1.
Results of initial and final testing of explosive leg strength



Initial testing

By means of the subject analysis we determined the results of the initial testing. Three players (2,7,8) in comparison with the rest of the experimental group achieved a considerably higher performance. The highest performance (39.6 cm in height) was achieved by player (7). Two players (10, 12) achieved a considerably substandard performance and another player (12) achieved a very low performance (only 18.7 cm in height). The rest of the players achieved an average performance. The average explosive leg strength on the team was 30.4 cm in height.

Final testing

During the final testing of explosive leg strength 11 out of 12 players achieved a higher performance in comparison with the initial testing. The highest performance was achieved by player (7) with 43.3 cm, where she improved her performance by 3.7 cm (9.3% performance improvement). The lowest performance was achieved by player (12) who had the lowest performance in the initial as well as final testing regarding jump height. This player certainly achieved the lowest performance (21.4 cm) in the final testing in comparison with the rest of the team. However, the increase of her performance constitutes 2.7 cm, which in her case means an improvement of 14.4%. On the whole it is the highest improvement within the team. Taking into consideration that this player fulfils the function of a libero (defence player) and in the training process she is not involved in exercise that develops explosive leg strength, such findings are not surprising. The leg explosiveness average of the team during the final testing was 32 cm, which constitutes an improvement of the jump height by 1.6 cm and this in comparison with the initial testing represents an improvement by 5.4%. Regarding the recorded p level 0.010, we have observed changes at a significance level of the p-value, $p < 0.05$.

Using the intra-individual analysis for recording the achieved performance in the jump height during the final testing, we recorded two players (7, 9) whose improvement was significantly higher. Players (2, 3, 4, 5, 6, 8, 10, 11, 12) achieved an average improvement and a player (1) significantly decreased in her performance. The player (9) was recorded with the highest improvement in explosive leg strength, even though she achieved only an average performance during the initial and final tests. Her improvement constitutes 3.8 cm, which represents an improvement of 12.8%. The player (1) who achieved an average performance during the initial and final tests, decreased in her performance during the final testing by 1.5 cm, which represents a decrease of her performance by 4.5%. We presume that her performance could have been influenced by the beginning health problems of the locomotive apparatus.

DISCUSSION

The aim of the comparison of the initial and final jump height evaluation was to record several changes in the performance of explosive leg strength within a group. We recorded an average increase in performance by 1.6 cm, which represents a statistically significant improvement of a group ($p<0,05$). Many authors (McNelly, & Sandlera, 2007; Přidal, & Zapletalová, 2010) state that training focused on explosive leg strength is to be implemented 2 – 4 times a week during the preliminary period. Since we implemented the development of explosive leg strength during the competition period we decided to implement only 2 training sessions. The training sessions continued over a period of 6 weeks, although measurable

changes can be achieved after 4 – 6 weeks. According to Hubka (1970) it is vital to take into consideration the distinct biological differences of the female body, especially when the strain of persistent and strength character is implemented. There must be a slower rate of strain increase on the female body and at the same time the rapid escalation of training power cannot be expected as high as in male volleyball players. Therefore we were not surprised by the low average increase in performance (only 1.6 cm). Our goal was the development of the explosive leg strength of the female volleyball team during the competition period and not the preliminary one, which is more suitable for the development of locomotive skills due to ample time.

An in-depth analysis revealed that the difference between the highest and lowest take-off jump during the final testing is 21.9 cm. We assume that the above-mentioned difference is caused by the specific character of strain on individual players' functions and this statement is confirmed by many authors (Lenhert, 2007; Vavák, 2011). The player (12) whose function on the team is libero had the lowest explosive leg strength and the player (7) who is the spiker had the highest explosive leg strength. Taking into account the achieved results we can pronounce that the specific exercises implemented 2 times a week during the 6 week-long period in the competition period had a positive impact on the development of the explosive leg strength of the female volleyball team.

CONCLUSION

The results of our work show the possibility of implementing conditioning trainings even during the competition period, in which case the players are able to maintain their performance acquired during the preliminary period. The positive impact of these exercises was confirmed with statistical significance ($p<0.05$). Since the number of our experimental sample is small ($n = 12$), the achieved results cannot be generalized.

Regarding the above-mentioned results, the author recommends:

- developing the explosive leg strength of female players during the competition period,
- implementing conditioning training 2 times a week during the 6 week-long period,
- using diagnostic devices so as to determine the current state of players.

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