EXPLOSIVENESS IN TRAINING PROCESS OF FOOTBALL PLAYERS

Dejan Milenković

Niš, Serbia

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Abstract

The research was conducted in order to determine the effectiveness of explosive strength plyometric training in training process of football players. A sample of 30 football players 16 years old was subjected to six-week plyometric training. On the other hand, a group of high school students of the same age and number which was included only in a regular physical education classes with two classes per week, had taken into research, as control group. Variables for the assessment of explosive strength included the following tests: squat jump-no arms, squat jump-arm swing and drop jump. Each of these variables was shown through a number of elements – time of flight, force of thrust on the ground and initial speed, while at drop jump in adition to mentioned elements time of contact was shown. The experiment was conducted at football club, in which the experimental group was subjected to programmed training in order to develop explosive strength for a period of six weeks, three times a week. The training was carried out in the last phase of the preparatory period. To process the data, the canonical discriminant analysis and multivariate analysis of covariance were used. The results showed that there was an increase in the level of explosive strength at football players compared to non-athletes.

Key words: *explosiveness, training process, plyometrics, football*

Introduction

In accordance with the requirements of modern training in football, every activity and every exercise that is practiced on the training must be put into game function, which is the starting point of the whole working process. As the basis and essence of football, it needs a good knowledge of game, which implies understanding of game modes, analyzing its dynamics, knowledge of the basic laws of the game, the recognition of typical situations in different stages and aspects of the game. It must also be taken into account the objective assessment of the values and potentials of the players, their technical and tactical skills, and physical fitness. As a predominantly aerobic-anaerobic sport (Bangsbo, 1994, Verheijen, 1997), there is a great aerobic load of players in football as a result of the increasing acceleration of the game. It is no longer enough to have a technical and tactical qualities, but if the coaches notice that their players are inactive, leading to the conclusion that they are conditionally unprepared, they are as such not needed to the team.

In today's football, game depends on the speed and explosiveness, so the players are faster and more explosive, striking at the ball are much stronger and duels are also much tougher. Therefore, within the fitness training it takes a lot of work to improve explosive strength of the players, as the ultimate goal in the development of strength. By equally increasing of strength and speed, explosiveness is increasing. Explosive strength is centrally conditioned, ie. by type of nervous system as it primarily depends on the number of activated motor units (Malacko, 1982). The genetic component is about 80%. It is defined as the ability to manifest maximum strength for maximum short time or as ability to activate the maximum number of muscle units.

These are various jumps, 100m or 200m run, sport games, karate, boxing, throwing in athletics, and movements to be performed in a short period of time. Explosive strength is the ability of young people, because the best results are achieved from 18-22 years old, it is retained up to 28 years old, and after that it begins to decline. After 35 it is reduced by almost 60%. The most effective and commonly used method to improve explosive strength in football is plyometrics, known as a method which focuses on linking strength with speed of movement to produce power.

Plyometric training requires good preparation and according to Bompa (2000), that preparation is reflected in the development of joint flexibility, tendon strength first of all, then muscle strength, body strength and the strength of extremities. The basic principle of plyometric training is shortening of stretch-shortening cycle of muscle.

The stretching of the agonistic muscles is increased and they become tolerant of shortening the cycle of eccentric-concentric contraction (stretch-shortening), and their impact is greater. Muscles need more elastic potential energy, which causes its faster transfer from eccentric to concentric phase. Plyometric exercises are similar to movements used by footballer players, where they should show strength like sprinting, jumping, etc., making explosive-reactive type of movement, which is among other things essential for a good vertical reflection. The main purpose of plyometric training is the development of greater reactive force. In order to reaffirm the legality and development needs of explosive strength in football training, this study was conducted in order to determine the effectiveness of explosive strength plyometric training.

Methods

The research was carried out with 30 football players 16 years old, who was subjected by six-week plyometric training within their clubs. Control group which is the same age and the number, was taken from the population of high school students who were included only in a regular physical education classes with two classes per week. Three variables treated explosive strength for this study: squat jump-no arms – SQUAT, squat jump-arm swing – SQUATZ and drop jump – DROP. Each of these variables was shown through a number of elements – time of flight (TF), force of thrust on the ground (PWR) and initial speed (INSPD), while at drop jump, in adition to mentioned elements, time of contact (TC) was shown. Testing was performed by using Chronojump system as a multiplatform system for measurement, control and statistical data. The system consists of a contact platform and photocells that detect movements, of a chronopic (v3.0) as chronometric device that is designed to detect changes that are coming from a contact platform and photocells, of managing software and computer software that executes managing software, associated with chronometric device. Variables for research were taken from Bosco, Luhtanen & Komi, (1983). Mean as a segment of central tendency measures and standard deviation as a segment of dispersion measures were used from the descriptive statistical parameters.

From the area of comparative statistics parametric discriminative analysis and analysis of covariance were used.

The experimental treatment

The experimental group was subjected by programmed football training for developing of explosive strength in a period of six weeks, three times a week. The training was carried out in the last phase of the preparatory period with the load, which amounted the weight of its own body. Repetitions for each exercise were performed 30-60 seconds, top speed of movement, number of sets per workout was 8-10, and the rest was 3-5 minutes between sets. The six weeks working process consisted of the following exercises: - both leg jumps in place; - one leg jumps in place (left and right leg); - high and low skip; - squat jumps; - jumps from one foot to another; - both egs jump and one leg jumps to the side; - jumps with knees to chest; - long jump in place and over the cone (front, side and diagonal); - one leg jump to the side; - jump + sprint to the side; - high jump in place; - jumps over cones (hurdles) + sprint; - "zig - zag" jumps; - jumps with a turn of 180 degrees; - hexagon (with and without hurdles); - lateral jumps on both sides; - multiple drop jump in squat; - jumps to and from the rise, with and without turns.

Results

Table 1. Descriptive parameters

		Initial testing				Final testing			
		Exp. group		Contr. group		Exp. group		Contr. group	
Variables		M	SD	M	SD	M	SD	M	SD
SQUAT	TF	0.4	0.06	0.4	0.08	0.45	0.08	0.41	0.07
	PWR	324.37	74.11	324.05	72.77	363.88	102.66	336.2	71.29
	INSPD	1.93	0.32	1.92	0.38	1.97	0.35	1.98	0.29
SQUATZ	TF	0.42	0.08	0.4	0.08	0.47	0.11	0.39	0.1
	PWR	337.76	86.59	327.85	79.18	369.27	95.02	324.94	88.06
	INSPD	2	0.35	1.91	0.42	2.57	0.49	1.88	0.39
DROP	TC	0.3	0.11	0.31	0.13	0.27	0.1	0.29	0.06
	TF	0.44	0.08	0.43	0.06	0.49	0.1	0.44	0.07
	PWR	43.02	69.22	26.57	10.52	28.98	11.42	28.35	8.06
	INSPD	2.14	0.34	2.07	0.3	2.59	0.34	2.14	0.3

Legend: M – Mean, SD = Standard deviation

The next chapter presents the results of explosive strength obtained by statistical analysis from the initial and final testings. The inter-group relations and relations among the groups were calculated in the observed space.

Coefficients which showed a significance level (P-level), have labeled as asterisks (* or **) if statistical significance was indicated. One asterisk (*) indicates a confidence level of 95%, while two asterisks (**) were in accordance with a confidence level of 99%.

Table 2. Discriminant analysis of differences between two testings of experimental group

Table 2a

	SQUAT
P-level	.043*
Variables	Root 1
TF	0.838
INSPD	0.228
PWR	0.128
Group	Root 1
G_1:1	-0.263
G_2:2	0.263

Table 2b

	SQUATZ
P-level	.049*
Variables	Root 1
INSPD	0.651
TF	0.585
PWR	0.259
Group	Root 1
G_1:1	-0.266
G_2:2	0.266

Table 2c

	DROP
P-level	.015*
Variables	Root 1
TC	0.644
INSPD	-0.538
TF	-0.206
PWR	-0.106
Group	Root 1
G_1:1	0.219
G_2:2	-0.219

Discriminant function (Table 2) showed a statistically significant difference between two testings of the experimental group in all three variables and their elements at the level of .05 (95% confidence level), (SQUAT .043; SQUATZ .049; DROP .015). The coefficients of the factor structure of the individual tests in Table 2a showed that the largest contribution to the discriminant function in squat jump-no arms (SQUAT) was given by the time of flight (TF 0.838). Taking into consideration of the sign of the group centroids (-0.263 and 0.263), the difference was in favor of the final testing, which was a better result. In Table 2b, the element of the squat jump-arm swing (SQUATZ) that gave the largest contribution to the separation was initial speed (INSPD 0.651). The sign of the group centroids (-0.266 and 0.266) also indicated a difference in favor of the final testing (better results). The time of contact (TC 0.644) and initial speed (INSPD -0.538) were the largest contributors to the differences in drop jump (DROP). Group centroids (0.219 and -0.219) with their sign were in favor of final testing at initial speed (INSPD), time of flight (TF) and force of thrust on the ground (PWR) - better results. In case of time of contact (TC), the numerical difference was in favor of the initial testing, however, it is a weaker result. Table 3a shows the multivariate analysis of covariance for the three variables of explosive strength obtained by determining of the achieved effects of programmed football training obtained in the final testing with the neutralization of recorded differences in the initial testing. It can be concluded that there is a statistically significant effect of training program conducted in the experimental group in all variables. Squat jump no arms (SQUAT .031) and squat jump arm swing (SQUATZ .036) are at the significance level of .05, while the drop jump (DROP .010) is at a significance level of .01.

Table 3. The effect of the experimental treatment (analysis of covariance)

Table 3a

Variables		SQUAT	SQUATZ	DROP
MANCOVA	F-test	3.05	2.95	3.53
	P-level	.031*	.036*	.010**

Table 3. Multivariate analysis of covariance

Table 3b

Var.	ANCOVA	F-test	P-level
SQUAT	TF	3.41	.011*
	PWR	1.46	.268
	INSPD	1.86	.138
SQUATZ	TF	2.48	.048*
	PWR	1.73	.170
	INSPD	2.50	.047*
DROP	TC	2.90	.017*
	TF	2.72	.035*
	PWR	1.84	.111
	INSPD	2.55	.045*

Watching at the individual values of the analysis of covariance between the experimental and control groups (Table 3b), there was a statistically significant effect in the time flight of squat jump-no arm (TF/SQUAT .011) at the .05 level of significance. At squat jump-arm swing (SQUATZ), statistically significant elements are time of flight (TF .048) and initial speed (INSPD .047) at .05 level of significance. Drop jump (DROP) has three significant elements: time of contact (TC .017), time of flight (TF .035) and initial speed (INSPD .045) at .05 level of significance. Based on interpretations of existing results, it can be concluded that the programmed football training positively influenced the development of explosive strength in experimental groups of football players.

Discussion and conclusion

In modern football it is tending to greater intensification of the game, so more players who can move quickly, execute the elements of offensive tactics, play from leg to leg, jump, perform defensive tasks and etc. are needed. For all that, of course, a different fitness training is necessary than before, when one player can play the entire game in continuity, which is no longer the case. To create such a versatile player, it is necessary to start training in the earliest age, including training of explosiveness, which is often combined with speed and agility training. A solid foundation for future upgrade is creating this way. The season is long and its unpredictability is another challenge to be addressed. Therefore it is necessary to follow the form of players, and the task of monitoring the effects is to provide more reliable data.

That data that will serve not only for the evaluation of certain training tasks, but for taking possible corrective intervention in the practical implementation of the working program as the basis of data and evaluation (Zaciorskij, 1975; Željaskov, 2003). Researches of explosiveness point out the great importance of this component in the development of all football players, both as independent (Joksimović, 2005; Sukreški, 2010) and in combination with other physical abilities (Wisløff et al., 2004; Ujević et al., 2007; Jozak et al., 2010; Sporiš et al., 2011). Explosiveness in every movement in the game that football player is performing, allows him a potential advantage over the opponent, thus he can put himself in a situation of expression the level of his technical and tactical knowledge. Dribbling from place that can be seen in today's football matches is almost impossible to successfully perform, if the explosive strength is at a low level, because there is no chance that anyone in this situation can be thrown off balance. Therefore, it is necessary to constantly improve the skills, because according to Bisanz & Wyeth (2000) concept of football is reflected in the fact that everything what is still top form and represents success in football, tomorrow can be easily overcome, and it should not be too long to follow the same concept of game and training. As already mentioned, plyometric method is currently the most widely used and most effective way to develop explosiveness, as it was founded in previous surveys (Impellizzeri et al., 2008; Rønnestad et al., 2008). Regarding this study, it can be said that the basic assumption which indicated that programmed football training in pre-season period was effective physical activity for improving the explosiveness of football players was confirmed. The program which was carried out on this occasion gave positive results at observed ability and it prepared participants for a successful competition season at least when we were talking about explosive strength. Thus, the aim of this paper was fulfilled because the statistically significant efficacy of plyometric training on explosive strength development of football players was recorded.

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EKSPLOZIVNOST U TRENAŽNOM PROCESU NOGOMETAŠA

Sažetak

Ovo istraživanje je provedeno s ciljem utvrđivanja učinkovitosti eksplozivne snage pliometrijskog treninga u trenažnom procesu nogometaša. Uzorak od 30 nogometaša uzrasta 16 godina sadržavao je sudionike šestotjednog pliometrijskog treninga. S druge strane, grupa visokoškolskih studenata istog uzrasta i broja koja je bila uključena u standardnu nastavu tjelesnog odgoja sa dva sata tjedno, uzeta je u istraživanje kao kontrolna grupa. Varijable za opis eksplozivne snage uključivale su: skok bez ruku, povratni skok i skok s propadanjem. Svaka od ovih varijabli praćena je kroz brojne elemente – vrijeme leta, sila odriva s tla i inicijalna brzina, dok je uz to kod skoka s propadanjem zabilježeno i vrijeme kontakta. Eksperiment je proveden u nogometnom klubu, gdje je eksperimentalna grupa sudjelovala u programiranom treningu s ciljem razvoja eksplozivne snage u razdoblju od šest tjedana, tri puta tjedno. Trening je primjenjen u zadnjoj fazi pripremnog razdoblja. Za obradu podataka korištena je kanonička diskriminativna analiza i multivarijantna analiza kovarijance. Rezultati su pokazali da postoji povećanje razine eksplozivnosti kod nogometaša u usporedbi sa nesportašima.

Ključne riječi: *eksplozivnost, trenažni proces, pliometrija, nogomet*

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Correspondence to:
Dejan Milenković, PhD
18000 Niš, Bul. Sv. cara Konstantina 41/6, Serbia
Phone: +381 (0)18 229 722
E-mail: dejan_milenkovic79@yahoo.com