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Original Article

Efficiency of performing rugby's technical elements depending on the speed and strength quality level of 16-18-year-old rugby players

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Abstract:
Purpose: The aim of this study was to assess relationship between speed-strength abilities and technical elements of the game. Further aims was to assess the effect of specialized training on speed-strength abilities and technical elements of the game. Methods: Thirty male rugby players participated in the experiment (age 17.3±1.1 years, the body height 181.5±4.7 cm, and body weight 109.7±9.8 kg). All athletes were participants of the Ukrainian Championship under 18 age category. The study was conducted from September 2017 to June 2018. A special program of speed-strength training was developed, which contributed to the improving of technical preparedness in the competitive conditions of rugby teams. The measurement of speed-strength abilities and technical preparedness were performed before and after training programme. The relationship between speed-strength abilities and technical preparedness was assessed by Pearson correlation analysis. Results: Our study showed significant relationships between the indicators of speed-strength skills ($p<0.05$) and technical preparedness of rugby players ($p<0.01$) aged 16-18 years old. The improvement of indicators of speed-strength skills and technical preparedness under the influence of the experimental program ($p<0.05$) were established. Conclusions: During the speed-strength training, the effectiveness of applying the established experimental program for the development of speed-strength skills as a basis for improving the performance of technical elements for playing rugby players was proved. The test scores of the speed-strength skills significantly correlate with the indices of the technical preparedness of the athletes, justifies the necessity of their development for training of rugby players.
Key words: rugby, speed-strength skills, special exercises, technical skills.

Introduction

For the achieving a high level of fitness of athletes in sports games, the need for the development of speed-strength abilities increases. Kozina, Bazylyuk, & Boyko (2017) found that when teaching the basic techniques, emphasis should be placed on the speed-strength aspect of the performance of space-time parameters of technical movements. Bykova (2016) determined the influence of the level of speed-strength and coordination abilities of handball players of 13-14 years on the effectiveness of their gaming activities. Nesen, Pomeshchikova, Druz, Pasko, & Chervona (2018) achieved an improvement in the technical preparedness of handball players on the basis of the development of speed-strength abilities. Rovniy, et al., (2018), confirm the necessity of coordination abilities development as a basis for controlling the technique of motor actions, which ensures the manifestation of motor skills during the competitive activity. Ashanin, et al., (2018), studied the complex impact of physical preparedness indicators and functional state of the athletes body 12-13 years old under the influence of rugby training.

It is also known that in rugby events on the playing field occur technical and tactical elements with a high intensity (Tsos, et al., 2018). This high pace of the game depends on the functional capabilities of the

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athletes body. Rovniy, Pasko, & Martyrosyan (2017) and Rovniy, Pasko, Dzhym, & Yefremenko (2017), presented that the level of sports achievements in rugby is formed on the basis of the development of functional capabilities that provide special performance. One of its main components is speed-power training, because the game is built on the constant manifestation of high-speed, strength and speed-strength skills of athletes.

Martyrosyan (2006) presented that the speed-strength skills of rugby players are necessary in the implementation of almost all technical elements of the game. In the conditions of sports confrontation, the effectiveness of many technical elements depends not only on the skill, but also on the speed with which they are executed. That is why the game activity of rugby players is largely determined by the level of development of speed-strength abilities (Pasko, 2014).

Scientific literature (Gabbett, Jenkins, & Abernethy, 2011; Nesen, Pomeshchikova, Druz, Pasko, & Chervona, 2018) indicate the connection between technical preparedness and the level of speed-strength quality of athletes and the effectiveness of their play activity. In our study, for the first time, a rugby training program was proposed, based on the influence of speed-strength work on technical preparedness. As a result of its experimental implementation, we obtained a higher growth rate of technical preparedness (6.15%) and speed-strength preparedness (5.57%). Similar studies were conducted (Martyrosyan, 2006; Sauls, & Dabbs, 2017). Our development is based on the results of their research and takes into account new trends in improving the efficiency of technical elements, based on the development of speed-strength skills.

Purpose of the study

The aim of this study to assess relationship between speed-strength abilities and technical elements of the game. Further aims were to assess the effect of specialized training on speed-strength abilities and technical elements of the game**.**

Ethical approval

The research related to human use has been complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the authors'. We also confirm that all of participants signed informed consent.

Materials and methods

Participants

Thirty rugby players with age 17.3±1.1 years, body height 181.5±4.7 cm, and body weight 109.7±9.8 kg participated in the study. All athletes were participants of the Ukrainian Championship under 18 category (15 athletes from the team "Sokol" city Lviv and 15 athletes from the team "Veres" city Rivne).

Procedures

The indicators of speed-strength skills of rugby players were determined using the following tests: running 30 m from high start (s), standing long jump (cm), triple jump (cm), vertical jump (cm), running 30 m with the ball (s), lifting the bar on chest (kg). Special (speed-strength) endurance was determined with the help of the shuttle run test (s).

For the assessment of technical elements were used following indicators: of technical preparedness: transfer of the ball in pairs (number of times), tackle (number of times), strike the ball "high ball" (m), catching the ball after the strike (number of times), kick and catch the ball on the move (number of times), a strike on range from the hands (m), "drop kick" (m), strike on goal (m).

The essence of the speed-strength training was the addition of the content of the training process of rugby players of with specially selected running and jumping exercises with weighting of the partners' weight and overcoming their resistance, which were performed in groups of two or three players. The distribution of players into groups of two or three players took place in accordance with the weight and maturation of rugby players.

Jogging exercises. 1) Running in pairs, from the front to the front line of the site with a change in the tempo of movement from the maximum to the slowest by the signals of the coach, repetition every 2-4 seconds. At the same time one of the players at the time of acceleration resisted the partner being behind or ahead of him.

2) Running for short distances (10 m, 15 m, 20 m) holding the partner on the back. Exercises were performed in series in which the distance (10 m, 15 m, 20 m) first increased and then decreased (20 m, 15 m, 10 m). Rest between passages was passive and lasted 10 seconds.

3) Running in threes in a line, holding hands, from the front to the front line of the site. At the signal of the coach, repeated every 2-3 seconds, the players performed either acceleration or resistance: if the central player was accelerating – the extreme players resisted him by pulling his hands back; if the extreme players were accelerated – the central player confronted them, dragging their hands behind them.

Jumping exercises. 1) Jumping on two legs, in length, up and down, overcoming the resistance of the partner holding the belt.

2) Jump with subsequent acceleration by 20 m, 30 m forward. Jump on two legs, from one foot to the other, in place and moving forward, holding the partner in front of you.

3) Jump on the arms, from the position of lying down, moving forward, backward, sideways.

In one training session, one exercise was used with weighting the weight or the weight of the partner and one exercise with overcoming the resistance of the partner. Both exercises were proposed for execution from different blocks: one running, one hopping, which was performed in series. Between the executions of exercises from different blocks, stretching exercises were given to the muscles, which took part in the previous work of 1-1.5 min.

The training load was 28 hours per week, which corresponds to the normative requirements of the rugby program for children and youth sports schools, specialized children's and youth schools of the Olympic reserve, schools of higher sportsmanship and specialized sports schools for athletes of this age and qualification. One training session was lasting 180 min 20-30 min of them are speed-strength training.

The experimental program was implemented in two basic training mesocycles, the total duration of which was 10 weeks. The time of application of the proposed speed-strength exercises increased in every third microcycle of training: first the number of repetitions in the jumping exercises increased, then in the running exercises and finally the weight and degree of counteraction of the partners increased.

Statistical analysis

The obtained data were processed using Statistica (version 7, StatSoft, Inc., Tulsa, OK, USA) software. Normality of data distribution was verified using the Kolmogorov-Smirnov test. To compare the indicators of speed-strength and technical preparedness between the control and experimental groups, analysis of variance (ANOVA) was carried out before and after the experiment. The significance level was set at 0.05 for all statistical tests. The Pearson correlation coefficient was used to study relationship between speed-strength abilities and technical preparedness. Significant level of correlation coefficient (with n=30) is considered: $r_{cr} \geq 0.36$ ($p<0.05$); $r_{cr} \geq 0.46$ ($p<0.01$); $r_{cr} \geq 0.57$ ($p<0.001$) (Denisova, Khmelnitsky, Kharchenko, 2008).

Results

The results of the test tasks for determining the speed-strength skills of rugby players of the experimental and control groups prior to the experiment are presented in Table 1. No significant difference was found between groups.

Also there was no significant difference at the baseline measurement between experimental and control groups in technical elements (Table 2).

After ten weeks, during which the training process of the rugby team of the experimental group was completed by specially selected exercises, a re-testing of the speed-strength indicators of the rugby players of the control and experimental groups was performed.

Comparison of experimental and control groups, after the experiment, showed significant differences in all speed-strength indicators (Table 1) and technical preparedness parameters (Table 2).

Table 1. Indicators of speed-strength skills of rugby players 16-18 years of control and experimental group before and after the experiment ($n_1=n_2=15$)

Indicators	Before the experiment				After the experiment			
	Control group	Experimental group	ANOVA		Control group	Experimental group	ANOVA	
	$\overline{X} \pm \sigma$	$\overline{X} \pm \sigma$	F	p	$\overline{X} \pm \sigma$	$\overline{X} \pm \sigma$	F	p
Running 30 m from a high start, s	4.64±0.20	4.66±0.15	0.09	>0.05	4.60±0.17	4.49±0.11	5.01	<0.05
Standing long jump, cm	221.3±9.7	223.7±12.32	0.33	>0.05	226.3±9.2	233.0±7.8	4.64	<0.05
Triple jump, cm	688.3±21.0	688.7±23.9	0.01	>0.05	691.3±17.9	703.7±14.1	4.41	<0.05
Vertical jump from the place, cm	45.6±5.1	44.7±4.7	0.27	>0.05	46.0±4.3	49.2±4.2	4.21	<0.05
Running 30 m with the ball, s	4.95±0.24	5.07±0.29	1.73	>0.05	4,89±0,17	4,78±0,08	4,77	<0.05
Lifting the bar to the chest, kg	74.7±6.7	78.7±7.9	2.25	>0.05	80.7±5.6	84.7±4.0	5.04	<0.05
Shuttle run (3x10 m), s	7.17±0.22	7.27±0.24	0.72	>0.05	7.07±0.20	6.94±0.14	2.07	<0.05

Table 2. Indicators of technical preparedness of rugby players of 16-18 years of control and experimental group before and after the experiment ($n_1=n_2=15$)

Indicators	Before the experiment				After the experiment			
	Control group	Experimental group	ANOVA		Control group	Experimental group	ANOVA	
	$\overline{X}\pm\sigma$	$\overline{X}\pm\sigma$	F	p	$\overline{X}\pm\sigma$	$\overline{X}\pm\sigma$	F	p
Transfer of the ball in pairs for 1 min, number of times	36.9±1.9	37.1±1.8	0.09	>0.05	38.0±1.5	39.0±1.1	4,37	<0.05
Tackle for 30 s, number of times	6.5±1.1	7.0±0.9	1.65	>0.05	6.8±0.9	7.4±0.5	4.73	<0.05
Strike the ball "high ball", m	27.3±3.6	26.7±2.3	0.24	>0.05	27.9±3.5	28.9±1.5	1.20	>0.05
Catching the ball after a stroke, number of times	7.0±0.8	7.6±0.7	2.39	>0.05	7.6±1.1	8.3±0.7	4.92	<0.05
Strike and catch the ball on the move, number of times	6.5±1.1	7.0±0.8	2.15	>0.05	7.0±0.8	7.6±0.5	6.51	<0.05
Strike on range from a hands, m	37.4±3.8	37.7±3.2	0.07	>0.05	38.3±3.1	39.1±2.9	0.45	>0.05
"Drop-kick", m	34.1±3.8	33.8±3.3	0.04	>0.05	35.1±2.8	35.6±2.3	0.32	>0.05
Strike on goal, m	35.3±3.8	36.4±2.2	0.90	>0.05	36.0±2.7	37.6±1.0	4.65	<0.05

Correlation analysis between speed-strength skills and tactical elements showed significant relationship between most of variables (Table 3).

Table 3. Correlation interrelation of indicators of speed-strength skills and technical preparedness of rugby players of 16-18 years old (n=30)

Technical indicators	Speed-strength skills						
Transfer of the ball in pairs for 1 min, n	-0.42	0.69	0.56	0.42	-0.52	-0.17	-.66
Tackle for 30 s, number of times	-0.34	0.10	-0.04	-0.10	-0.06	0.47	-.27
Strike the ball "high ball", m	-0.42	0.48	0.59	0.67	-0.43	-0.24	-.53
Catching the ball after a stroke, number of times	-0.06	-0.07	-0.03	-0.15	0.20	0.47	.06
Strike and catch the ball on the move, number of times	-0.31	0.37	0.22	0.20	-0.09	0.15	-.17
Strike on range from a hands, m	-0.50	0.57	0.67	0.78	-0.58	-0.30	-.62
"Drop-kick", m	-0.50	0.66	0.70	0.83	-0.51	-0.37	-.54
Strike on goal, m	0.01	0.47	0.39	0.30	-0.04	-0.03	-.17

Note. At n=30: $r_{cr}\geq0.36$ ($p<0.05$); $r_{cr}\geq0.46$ ($p<0.01$); $r_{cr}\geq0.57$ ($p< 0.001$)

Discussion

Presented study showed the importance of development of speed-strength skills of young rugby players for improvement of technical preparedness.

Also other scientists (Gabbett, Stein, Kemp, & Lorenzen, 2013) emphasized to focus rugby players preparation on the physical training especially of speed-strength skills. In addition, the significance of the rugby players' speed-strength abilities is increased with increasing the intensity of the game due to a large number of short-distance accelerations and creating a large number of fast arbitrary fights (Delaney, et al., 2017).

The study by Worsfold, & Page (2014) showed that there is a correlation between the performance indicators of technical actions and the evaluation of the indicators of the effectiveness of actions, namely the speed of movement, the accuracy of movements and the rotation of the ball, and the execution time. Sinclair, et al. (2014) and Quinn, Sinclair, & Atkins (2015) investigated the influence of the level of speed and speed-strength abilities on the technical and tactical preparedness of players in rugby, namely, the relationship between the trajectory of the lower limbs and the speed of impact on the ball in rugby, which is significant in technical and tactical training and competitive activity of athletes. Our research extends data on the relationship of speed-strength indicators to the degree of manifestation of the technical elements of the game: transfer of the ball in pairs, strike the ball "high ball", a strike on range from the hands and "drop kick". After the intervention in some indicators, no significant differences were observed between the control and experimental groups. This is explained by the fact that in the control group, as well as in the experimental group, there was also an

improvement in some indicators of technical preparedness: Tackle for 30 s, Strike on range from a hands, "Drop-kick". The rugby training program developed by us differs from the traditional one and also makes it possible to improve technical preparedness.

Studies by Higham, Pyne, Anson, & Eddy (2013), Speranza, Gabbett, Greene, Johnston, & Sheppard (2017) and Matthew, Simon, & Hayden G. (2017) emphasize the importance of support and high level of speed-strength skills of rugby players for effective performance of technical and tactical actions during the game season.

In our studies, the indicators of the development of speed-strength skills have been obtained that testify to the advisability of introducing a system of specially selected exercises into the training process of players. These results are confirmed by studies of Taskin, & Bicer (2015), Thakur, Mishra, & Rathore (2016) and Çđmenlđ, Koç, Çđmenlđ, & Kaçoğlu (2016), to develop appropriate training techniques for athletes. In addition, the level of development of explosive speed, speed endurance and strength affects on the intensity of the game activity of rugby players (Condello, et al., 2013).

Also, Portillo, Abián, Navia, Sánchez, & Abian-Vicen (2014) found that the use of special training exercises for physical training in the training process of rugby players contributes not only to the development of speed-strength skills, but also to the further improvement of the technical skills of rugby players that are manifested in various game situations on the field. Rugby training program developed by us influenced the improvement of speed-strength qualities by 5.57% and technical preparedness indicators by 6.15% among athletes of the experimental group.These indicators also improved among the athletes of the control group, but to a lesser extent: speed-strength preparedness – 2.27%, technical preparedness – 4.17%.

Conclusion

The results of the study indicate significant relationships between speed-strength skills and technical preparedness of rugby players. Training intervention including running and jumping exercises, which were used in the training process of rugby players of 16-18 years old, led to a significant increase in speed-strength characteristics and technical preparedness of rugby players of the experimental group compared to rugby players of the control group.

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Conflict of interest

The authors state that there is no conflict of interest, which can be perceived in such a way that it can damage the impartiality of the article.

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