Original Article

Relationships between technical-tactical and physical preparedness of 13–14-year-old skilled football goalkeepers

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Abstract:
Problem Statement. Modern changes in football complicated the goalkeepers' role. It is impossible to improve the technical & tactical preparedness of young skilled goalkeepers without finding new approaches in the organization of their training process. *The purpose of the research* was to determine the indicators of physical and technical-tactical readiness of 13-14-year-old goalkeepers and the relationship between them. *Methods:* theoretical analysis and generalization of scientific and methodological literature, pedagogical testing, and mathematical statistics. *Participants:* 46 young players of 13-14-year-old of football club "Arsenal" in Kharkiv city, including 6 goalkeepers, 8 central defenders, 8 full-back defenders, 8 central midfielders, 8 wing midfielders, 8 forwards. *Results:* Quantitative indicators of motor actions of 13-14-year-old football players of different game role according to the results of 10 calendar games were determined. It was established that the quality of performance of technical and tactical actions of young football players was not the same for players of different game roles. Goalkeepers mainly make long and short passes (29.8 ± 1.19 and 27.2 ± 1.16 % of the total number of technical and tactical actions). The largest number of movements with the back forward, cross step and additional step was made by the goalkeeper (12.3; 7.0; 2.6 % of game actions per game), which were statistically significantly higher in relation to all field players (p <0.001). Goalkeepers during the game perform more jumps (32.4 ± 1.48 % of all motor actions) and throwing the ball (26.4 ± 1.48 %). Goalkeepers' indicators of speed and power capabilities (in the test "Standing high jump") were statistically significantly superior (p <0.05) to players of all other lines. The correlations between the test indicators that reflect the level of goalkeepers' physical fitness were determined. A statistically significant correlation was established between the indicator "Standing high jump" and "Running 30 m" (ρ= -0.82, p <0.05), indicators of starting and distance speed (ρ = 0.84 and ρ = 0.86, p<0.05), the indicator "Running 10 m" with "Running in 6 min", which characterized the overall endurance (ρ = -0.83, p <0.05). *Conclusions:* Goalkeepers are characterized by the relationship between all technical & tactical actions of the game and the level of motor skills development, namely the statistical significance of the correlation between speed and speed-power qualities and technical & tactical indicators was confirmed.
Key Words: young footballer, goalkeeper, physical qualities, technical & tactical actions, correlation.

Introduction

Goalkeeper is a key position in football. The role of a football player determines the required level of development of physical abilities. The technique of the goalkeeper's game consists of two parts: the technique of attacking and defending the goal. He takes part in attacks when the ball is under his control. After catching a ball that hit the goal or towards the goal, he is the first player to launch his team's attacks. His accurate serve is the beginning of the attack. At the same time, inaccurate serve, passing the ball or passing to a closed partner is very risky. The arsenal of the goalkeeper's technique also includes such elements as: dribbling, hitting the ground after catching, throwing a hand and kicking the ball (motionless from the goal, from the hands after catching). It is necessary to take into account the role of young football players when developing their physical abilities in the training process.

Much attention is paid to physical training, response speed and resoluteness of the goalkeeper. The goalkeeper is the only player on the team who is allowed by the rules of the game to catch the ball with his hands within the penalty area. Therefore the playing as a goalkeeper is most important place in football that requires a special program for goalkeeper's training (Lisenchuk et al., 2021). The footballer's age of 13-14 year is also a

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special attention because this is a sensitive period for physical qualities development (Bairachny et al., 2018). Carp, Sîrghi & Ciorba (2018); Suvorov (2019) emphasize the need for differentiated physical training of football players depending on the game specialization, which is due to the difference in the functional support of their special work capacity. The authors draw attention to the features of adaptive reactions of the cardiovascular system and reactions of analytical systems in football players of different game specializations (Malina et al., 2004; Kunz et al., 2019). Philippaerts et al. (2006) researched the relationship between peak height velocity and physical performance in youth soccer players. Votteler & Höner (2014) examined complex relationships among relative age, physical development and motor performance by modelling the direct and indirect effects of relative age on single motor performance tests for sprint, running agility, dribbling and ball passing and control. At the same time there is no a coherent approach towards the differentiated physical training of skilled junior football goalkeepers. Improving the system of young goalkeepers' training is impossible without finding new fundamentally possible approaches and methodological solutions in the organization of the training process (Halouani et al., 2017; Leibo et al., 2021). We need to know what correlation is between goalkeeper's physical and technical-tactical preparedness in order to influence to his performance. So **the purpose of the research** was to determine the indicators of physical and technical-tactical readiness of 13-14-year-old goalkeepers and the relationship between them.

Material & methods

Participants. The research group consisted of skilled football players (n=46) of football club "Arsenal" (Kharkiv city) in the U14 age category. The average age of this group during this research was 13.9±0.81 years. The research involved 6 goalkeepers, 8 central and 8 full-back defenders, 8 central and 8 wing-back midfielders and 8 forwards. All participants were informed of the requirements prior to the research, and their parents and coaches gave their informed written consent for them to participate. The local research ethics committee in the spirit of the Declaration of Helsinki approved all procedures.

Procedure. The indicators obtained by 46 football players during 10 games of the competitive period (May-October 2018) were used as the data of their technical & tactical and motor actions.

Statistical Analysis. The descriptive statistics was used to determine the following parameters: arithmetic mean – $\overline{x}$, standard deviation – SD, m – standard error. The Shapiro Wilk test was used in testing for normality. As samples of technical & tactical actions were normally distributed t-test was used to determine the statistical significance of the differences between two independent samples. As samples on goalkeepers' physical qualities were small (n=6), median, upper and low quartiles Me (25 %; 75 %) were determined. The nonparametric Mann-Whitney U test as the most powerful criterion for independent samples was used to determine the statistical significance of differences between the indicators of football players of different game role. Correlation analysis computed on data of 6 goalkeepers by nonparametric Spearman's rank correlation coefficient ρ as monotonic trend between the samples of physical qualities and technical & tactical actions of 13-14-year-old goalkeepers per the game was observed via visual and calculated statistical analysis of scatterplots. Critical value of rank correlation for testing the hypothesis of independence was determined by Glasser & Winter (1961). A significance level (that is, the probability of error) was assumed to be p = 0.05 and some results were obtained at the level p=0.001. Statistical analysis was performed using the Statistica 10.0 (StatSoft, Inc).

Results

The results of the study of physical development level (height and body weight) of young football players of different game roles (Table 1) allow us to confirm the presence of differences in morphological indicators. If these differences are less pronounced in field players, the advantage of goalkeepers in terms of body height is fully confirmed (p <0.05). Even greater differences are observed in footballers' body weight. The greatest body weight was observed in goalkeepers (p <0.05).

Table 1. Indicators of physical fitness of 13-14-year-old football players of various game roles (n = 46)

Indicator	Footballer's position						
	Goalkeepers (n=6)				Defenders (n=16)	Midfielders (n=16)	Forwards (n=8)
	$\overline{x}$ ±m	Me	25 %	75 %	$\overline{x}$ ±m	$\overline{x}$ ±m	$\overline{x}$ ±m
Body height, cm	163.7 ±1.1*	163.5	159.4	166.4	158.3 ±1.4	156.3 ± 1.7	154.1 ± 3.3
Body weight, kg	47.7 ± 2.3*	48.0	45.1	53.0	41.5 ± 2.1	40.0 ± 2.0	38.8 ±3.6
Running 10 m, s	1.90 ± 0.03	1.87	1.84	1.97	1.86 ± 0.02	1.84 ± 0.02	1.80 ± 0.01*
Running 30 m, s	4.75 ± 0.06	4.78	4.73	4.80	4.50 ± 0.02	4.48 ± 0.03	4.42 ± 0.02*
Running 180 m, s	43.8 ± 0.7	43.5	42.3	46.2	42.7 ± 0.4	41.7 ± 0.3*	42.6 ± 0.4
Running in 6 min, m	1275 ± 31	1281	1274	1382	1315 ± 27	1331 ± 26*	1302 ± 29
Standing high jump, cm	34.6 ± 1.0*	33.8	31.4	38.2	32.5 ± 1.2	31.8 ± 1.2	31.3 ± 1.5

Note. * - the difference between the player's indicators of other game roles is statistically significant at the level p <0.05 (it was confirmed by the Mann-Whitney test)

Footballers of different game lines have a fairly clear distinction between them in terms of speed and power capabilities (Lisenchuk et al., 2021). Goalkeepers are superior to players of all other lines in terms of speed and power capabilities (in the test "Standing high jump") statistically significant (p <0.05). The high level of this indicator for goalkeepers is directly dictated by the exceptional importance of this component of physical fitness in the effective performance of technical and tactical tasks facing players of this role.

Table 2 presents the indicators of motor actions of 13-14-year-old football players of different game roles during competitive activities (n = 10 games). The largest number of movements with the back forward, cross step and additional step is made by the goalkeeper (12.3; 7.0; 2.6% of game actions per game), which are statistically significantly higher in relation to all field players (p<0.001).

Table 2. Number of motor actions during competitive activity (n = 10 games) by 13-14-year-old football players of different game role (n = 46), $\bar{x} \pm m$, %

No	Number of motion actions, %	Goalkeepers, n=6	Central defenders, n=8	Central midfielders, n=8	Full-back defenders, n=8	Wing-back midfielders, n=8	Forwards, n=8	Total number, $\bar{x}$	Total, %
1.	Jerks 15–20 m	12.6±0.47	14.1±0.45	14.0±0.49	16.6±0.52	14.6±0.50	26.7±0.76	16.4	98.6
2.	40–50 m acceleration	-	13.7±0.46	12.5±0.47	14.8±0.51	16.2±0.62	10.4±0.46	11.3	67.6
3.	Running backwards	12.3±0.46	5.0±0.24	5.6±0.25	2.2±0.18	3.4±0.23	5.8±0.25	5.7	34.3
4.	Cross-step running	7.0±0.37	3.4±0.22	3.2±0.22	2.1±0.21	2.0±0.21	3.0±0.22	3.5	20.7
5.	Shuffle running	2.6±0.12	1.6±0.09	1.8±0.10	1.6±0.09	1.7±0.10	1.8±0.11	1.8	11.1
6.	Tackle	6.0±1.32	19.1±1.31	21.5±1.40	19.2±1.30	20.8±1.29	26.1±1.45	17.8	106.7
7.	Header	0.7±1.36	4.8±0.34	7.8±0.38	5.7±0.35	7.1±0.38	12.8±0.46	6.5	38.9
8.	Throwing the ball	26.4±1.48	5.6±1.17	-	6.2±0.46	-	-	6.4	38.2
9.	Jumps	-	32.7±1.51	37.1±1.56	31.6±1.48	37.9±1.59	47.7±0.36	25.2	151.5
10.	Running per game, m	32.4±1.48	-	-	-	-	-	5.4	32.4
	Total, %	100	100	100	100	100	100	100	

Specific types of motor activity are appropriate to individual players. Thus, throwing the ball into the game takes 26.4% for the goalkeeper and 5.6% of the sideline for full-back defender and 6.2% for midfielder. Table 3 presents indicators of technical and tactical actions of 13-14-year-old football players of different game roles.

Table 3. Quantitative indicators of technical and tactical actions of 13-14-year-old football players of different game roles (n = 46) during competitive activity (for 10 games in average), $\bar{x} \pm m$, %

No	Technical & tactical actions	Goalkeepers, n=6	Central defenders, n=8	Central midfielders, n=8	Full-back defenders, n=8	Wing-back midfielders, n=8	Forwards, n=8	$\bar{x}$, %
1.	Short pass	27.2±1.16	29.3±1.18	28.4±1.16	28.6±1.16	29.4±1.19	28.8±1.15	28.6
2.	Medium pass	21.5±1.20	26.2±1.15	30.8±1.20	25.7±1.15	26.6±1.16	25.0±1.14	25.9
3.	Long pass	29.8±1.19	12.6±0.58	17.0±1.02	12.5±0.59	13.2±1.01	5.2±0.26	15.1
4.	Groundmove	0.3±0.03	9.7±0.41	3.2±0.28	9.8±0.42	7.8±0.36	16.2±1.01	7.8
5.	Dribbling	2.7±0.09	8.1±0.34	7.6±0.32	8.0±0.36	8.2±0.37	9.8±0.41	7.4
6.	Slide tackle	-	2.0±0.17	1.4±0.13	2.6±0.17	1.0±0.13	1.0±0.13	1.3
7.	Ball stop	17.9±0.36	9.6±0.41	8.6±0.36	9.2±0.40	9.4±0.41	8.2±0.037	10.5
8.	Kicks to the goal	-	1.2±0.13	1.2±0.13	1.4±0.14	2.4±0.17	2.6±0.17	1.5
9.	Header	0.6±0.03	1.3±0.12	1.8±0.17	2.2±0.18	2.0±0.17	3.2±0.18	2.0
	Total, %	100	100	100	100	100	100	100

--3441

Long passes are mostly used by goalkeepers (29.8% of all technical & tactical actions) and central defenders (17.0%). Goalkeepers, in accordance with the players of different game roles, use long passes much more in their game activity (p<0.001), especially when hitting the goal and in critical situations with overcoming the opponent's resistance. Thus, for goalkeepers, the largest percentage of technical & tactical actions fall on long (29.8%), short (27.2%) and medium passes (21.5%). The most difficult element of technique is the "Tackle", which is rarely performed by all field players, and is less than 2.6% of all technical actions of young footballers. Most motor actions are performed after the ball has stopped, which determines a corresponding, fairly uniform percentage of performance by each player. However, the "Ball stop" technique is mainly used by the goalkeeper, its percentage is higher than in full-back and central defenders (t = 15.09; 18.24; p <0.001), wing-back and central midfielders (t = 16.11; 15, 45; p<0.001) and forwards (t = 18.65; p <0.001). Table 4 presents the correlation coefficients of test scores that reflect the level of goalkeepers' physical fitness.

Table 4. Correlation matrix of relationships between the indicators of 13-14-year-old goalkeepers' physical fitness (n = 6)

No	or	1	2	3	4	5	6	7
1	Body height, cm	1						
2	Body weight, kg	0.79*	1					
3	Running 10 m, s	-0.51	-0.42	1			1	
4	Running 30 m, s	-0.51	-0.57	0.84*	1			
5	Running 180 m, s	-0.03	0.02	0.78*	0.86*	1		
6	Running in 6 min, m	0.43	0.58	-0.83*	-0.85*	-0.83*	1	
7	Standing high jump, cm	0.79*	0.64	-0.73	-0.82*	-0.80*	0.79*	1

Note. * - the correlation coefficient is statistically significant at the level of p <0.05 (critical value $\rho_{6;0.05} = 0.77$)

The data in Table 4 confirm the goalkeepers have a large amount of reliable correlations of speed and power abilities. The "Standing high jump" indicator has significant correlations with the indicators characterizing the speed abilities of young football players. Thus, the correlation is established between the indicator "Standing high jump" and "Running 30 m" (ρ = -0.82, p <0.05). The indicators of starting and distance speed are also interrelated closely (ρ = 0.84 and ρ = 0.86, p <0.05). The correlation relationship has "Running 10 m" indicator with "Running in 6 min", which characterized the overall endurance (ρ = -0.83, p <0.05). Thus, according to those results, the individual task for goalkeepers was an increase in the level of speed and speed-power qualities development.

Discussion

Football player's formation is a complex and multifaceted process. In technical terms, the technique of the goalkeeper's game has hardly changed over the last 20 years. The main difference is the control of the ball with the feet. In the physical aspect, modern play means that player's all physical qualities must be developed in individual training. At the same time, the excellent physical qualities of field players complicated the task of the goalkeeper. To become a successful goalkeeper, you need to learn special techniques and acquire such personal qualities as confidence, character and resoluteness, and everything should be encouraged at an early age (Williams & Reilly, 2000; Averyanov et al., 2021). Scientists (Solomonko et al., 2019; Krainyk et al., 2020) emphasize the need to take into account the sensitive periods of organism formation under the development of physical qualities. During the period of active biological development of 13-14-year-old footballers, the primary task is not to achieve maximum results, but comprehensive and harmonious physical development (Przybylski & Lisienczuk, 2002). This will ensure not only the active accumulation of technical & tactical arsenal, but also the creation of a foundation for qualitative increase of specific functional reserves (Forsman et al., 2016; Malina et al., 2004).

Psychologically, the goalkeeper must have the appropriate character traits that will play an important role in performing specific actions at the gate. He has to cope with the enormous pressure due to the peculiarity of the position (competition for a place), to take responsibility for the results. Tactical training involves the active participation of the goalkeeper in the attacking game and the fact that the goalkeeper assumes the role, which in the past was performed by the fullback in the defensive game. In this regard, the idea about the components of physical fitness is constantly improving, taking into account a range of game factors and the abilities of players (Bairachny et al., 2018; Simpson, 2015). Specialists (Williams & Hodges, 2005; Lisenchuk et al., 2021) emphasize the need for differentiated physical training of football players depending on the game specialization, which is due to the difference in the functional support of their special work capacity. In this regard, in the development of physical abilities during the training process it is necessary to take into account the role of young football players.

Another important issue is to determine the optimal levels and ratios of the various components of physical fitness (Bolotin & Bakayev, 2017; Balan, 2020). This is determined by the understanding that there is no need to maximize the development of all aspects of physical fitness in the training process (Zibung et al., 2016). Coaches of different clubs – representatives of 5 regions of Brazil (Alvim et al., 2018) indicate that the total time of physical training is slightly higher than the amount of technical and tactical training. Technical and tactical training is on average in 5 clubs up to 350 minutes per week, physical training in general - up to 650 minutes per week. Carp, Sîrghi & Ciorba (2018) optimized the structure and the content of the physical training for junior football players, based on differentiated exercise training of goalkeepers in a yearly training cycle. Tvrdý et al. (2020) recommend a differentiated development of endurance abilities using intermittent methods, which are specific for football and the incorporating more exercises for the development of explosive power of lower limbs (plyometric training) into training units.

The goalkeepers are superior to players of other game roles in terms of maximum anaerobic power, which is associated with "explosive", i.e. speed and power work capacity (Gissis, 2012; Simpson, 2015). In this regard our results are consistent with the data of a number of authors (Peráček, 2017; Montesano & Mazzeo, 2019), who note that the speed and strength qualities of goalkeepers are limiting in the structure of physical fitness. Our results are also consistent with those obtained in studies (Musalek & Kokstejn, 2019; Barba et al., 2020) on skilled players about the relationship between the jump power and the power of the best sprint performed.

Conclusions

The study of literature showed there is no a coherent approach towards the differentiated physical training of skilled junior football goalkeepers. The identification of the correlation of goalkeeper's speed and speed-power qualities with technical & tactical indicators gives the opportunity for the effective influence to his performance.

The advantage of goalkeepers in terms of body height and body weight comparing to players of another roles was confirmed ($p < 0.05$). The largest number of movements with the back forward, cross step and additional step was made by the goalkeeper (12.3; 7.0; 2.6% of game actions per game), that is statistically significant higher in relation to all field players ($p < 0.001$). Goalkeepers perform more jumps ($32.4 \pm 1.48\%$ of all motor actions) and throw the ball ($26.4 \pm 1.48\%$) during the game and goalkeepers mainly make long and short passes (29.8 ± 1.19 and $27.2 \pm 1.16\%$ of the total number of technical and tactical actions).

Statistically significant correlations of goalkeeper's speed and power abilities have been identified particularly between "Standing high jump" and "Running 30 m" indicators ($\rho = -0.82$, $p < 0.05$); between the indicators of starting and distance speed ($\rho = 0.84$ and $\rho = 0.86$, $p < 0.05$) and "Running 10 m" with "Running in 6 min" ($\rho = -0.83$, $p < 0.05$). Thus the individual task for goalkeepers was to increase the level of speed and speed-power qualities.

Conflicts of interest
The authors have no conflicts of interest.

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---3443

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