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ANALYSIS OF TEAMS POSITION DYNAMICS IN TOP THREE EUROPE'S FOOTBALL LEAGUES IN THE 2016–17 SEASON

The article focuses on the patterns of top, middle and outsider teams position dynamics in standings of top three European leagues (La Liga, Bundesliga, Premier League). The research is based on 1066 match outcomes of the 2016–17 season. The performed analysis determined a large gap between leaders and outsiders; top teams obtained their highest position in the middle of the tournaments' first half and held it until the end. According to team position dynamics, the tournaments can be divided into three periods: 1) teams reach positions corresponding to their level; 2) fluctuation of a team position within a group level; 3) keeping a position at the end of the competition with minimal changes possible. It was defined that about the 9th–10th rounds there occurred a turning point in the championships. Only one team in each league had the difference of 7 and more positions and 52 (89.7%) teams had the difference of fewer than 5 position between the results of the 9th round and the final results. The patterns of the performed analysis have been checked using the data of the 2017–18 season and have proved to be mostly relevant for the mentioned season.

Keywords: football, European championships, position dynamics, analysis

Николай Латышев, Олег Квасница, Ирина Квасница. Анализ динамики позиций команд в трех топ европейских футбольных лигах сезона 2016-2017. В статье рассматриваются динамика позиций топ, средних и аутсайдерских команд в трех ведущих европейских лигах (Ла Лига, Бундеслига и Премьер-лига). Исследование основано на результатах всех 1066 матчей сезона 2016-17. Согласно анализу данных турниры можно разделить на три периода: команды достигают позиций, соответствующих их уровню; колебания позиции команды на определенном уровне; сохранение позиции в конце соревнования с минимальными изменениями. Полученные модели были проверены на основании данных сезона 2017-18.

Ключевые слова: футбол, чемпионаты Европы, динамика позиций, анализ

Микола Латышев, Олег Квасница, Ирина Квасница. Аналіз динаміки позицій команд у трьох топ європейських футбольних лігах сезону 2016-2017. У статті розглядаються динаміка позицій топ, середніх і аутсайдерських команд в трьох провідних європейських лігах (Ла Ліга, Бундеслига і Прем'єр-ліга). Дослідження засноване на результатах всіх 1066 матчів сезону 2016-17. Згідно з аналізом даних турніри можна розділити на три періоди: команди досягають позицій, відповідних їх рівню; коливання позиції команди на певному рівні; збереження позиції в кінці змагання з мінімальними змінами. Отримані моделі були перевірені на підставі даних сезону 2017-2018.

Ключові слова: футбол, чемпіонати Європи, динаміка позицій, аналіз.

Introduction. Popularity of European football is undeniable and has been growing in recent years (Evens & Lefever, 2011; Mittag & Legrand, 2010, Vrooman, 2007). There is an annual increase in the number of television viewers and spectators at stadiums, in cost of maintaining clubs, sportsmen and coach salaries etc. In connection with it, the interest of specialists and scientists in this field has increased accordingly, which is supported by recent research (Coutts, 2014; Sarmiento et al., 2014). Moreover, in the last years some researchers (Clemente, Couceiro, Martins & Mendes, 2015; Petrunin, 2013) have suggested distinguishing soccer metrics as a separate scientific discipline in the field of football research. According to Petrunin (2013), analysis of Russian clubs performance between 2010 and 2013 shows that organizational and research aspects of management team work, done by coaching staff, are nearly of the same importance as financial resources.

In many European countries, a national football championship is the most important competition, and the victory is very prestigious for competing clubs. Because of it, analysis, modelling and forecasting of team results are an essential part of the sports research (Bampouras, Cronin & Miller, 2012; James, 2007). There are different approaches to the analysis of specific matches and competitions in general (Mackenzie & Cushion, 2013). The majority of studies analyze physical (Weston, Castagna, Impellizzeri, Rampinini & Abt, 2007), tactical and technical (Perl, Grunz & Memmert, 2013) or performance (Hughes & Franks, 2005) aspects of players and matches. Moreover, there are analyzed parameters of match location, quality of opposition, and match status (Taylor, Mellalieu, James & Shearer, 2008). These papers demonstrate how the mentioned parameters influence teams outcomes.

At the same time, there has been conducted a limited number of researches in the area of the team position dynamics and outcomes forecasting during championships. For example, Oberstone (2011) carried out the comparative analysis of team performance of the English Premier League, Serie A, and La Liga for the 2008–09 season with the aim of identifying the similarities and differences between these European leagues as well as establishing the key pitch factors that are associated with a team's ultimate success within its respective league.

A different approach is used for the forecasting and modelling of teams results (Barros & Leach, 2006), who has united financial and sports data in his study. Barros and Leach (2006) used the data envelopment analysis to evaluate the performance of English Premier League football clubs from 1998–99 to 2002–03 combining sports and financial variables. The paper evaluates how close the clubs are relative to the frontier of best practices, analyzing how they manage sport as well as financial results.

European top teams dominate in their domestic football leagues, as a result there is a lack of intrigue and unpredictability of top positions in standings (Pawlowski, Breuer & Hovemann, 2010). The huge gap between prize-winners and outsiders transforms the championships into competitions for outsider and middle places only (Michie & Oughton, 2004). For instance, as far as English Premier League is concerned, with reference to the 2000s period Smyth and Ashdown (2010) discussed "Big Four" teams

while Jolly (2013) considered top-6 ("Big Six") teams since the 2011–12 season. The mentioned top teams have totally dominated the Premier League in recent decades and only they could win championships. However, there has not been enough research into the dynamics of middle and outsider teams results. Consequently, the aim of the current study is to investigate the patterns of top, middle and outsider teams position dynamics in standings of top three European leagues.

Methods. UEFA rankings for club competitions. According to the official website of UEFA (www.uefa.com), 'the associations' club coefficients rankings are based on the results of each association's clubs in the five previous UEFA Champions League and UEFA Europa League seasons. The rankings determine the number of places allocated to an association (country) in forthcoming UEFA club competition.'

The given research studies top three European Championships on the basis of UEFA ranking (published on 06 June 2017). At the end of 2016–17 season, clubs from Spain had 104.998 points, clubs from Germany – 79.498 points and English teams obtained 75.962 points. Furthermore, seven clubs of each of the three championships had an opportunity to qualify for UEFA Champions League or UEFA Europa League in the following season (2017–18).

Data set

We studied data of the top three European football championships of the 2016–17 season. All 1066 match outcomes of three leagues have been analyzed. Spanish La Liga and English Premier League included twenty clubs and every club played 38 matches during the season. The total number of matches was 380 in each league (Spain and England). Eighteen clubs played 306 matches in Bundesliga (Germany), i. e. 34 matches per team.

In order to check the patterns that have been identified in the current work, the analysis of teams results of the 2017–18 season has been carried out. The analyzed data consists of team positions after the 9th, the 10th and the latest rounds for the same three championships (on 16 March 2018, the latest rounds were the 28th round for Spain, the 26th round for Germany and the 30th for England). It is worth noting that six teams will have an opportunity to play in UEFA Champions League or UEFA Europa League. Therefore, a top group consists of six teams in each league in the 2017–18 season.

Analyzed parameters. All teams for each league were divided in three groups according to the final results. The first group includes first seven teams which obtained an opportunity to play in UEFA Champions League or UEFA Europa League (later called top teams). The second group (middle teams) comprises ten teams (eight teams in Bundesliga) which occupied positions between top teams and outsiders; they stayed in the highest league in the following season, but could not play in Champions League or Europa League. Finally, the third group consists of outsiders (three teams); they were relegated to a lower division for the following season (2017–18).

The research focuses on the following:

1. The final position in standings and obtained points were analyzed with the aim to identify the difference between teams which ended at the top, middle and outside positions. In addition, a gap between winners and outsiders was estimated.

2. The number of positions between the current position of a team after every round and its final position was calculated. For example, the 13th team after the 1st round was Villarreal, but the final result of the mentioned team was the 5th place. Therefore, the difference between the club's position after the 1st round and the final result was 8 positions. The program was used to sum the total number of differences for every round of three leagues. The data was converted into a table and the graph was built using Microsoft Excel 2013. The graph shows how the total number of positions differences varied during championships. It is noteworthy that postponed matches were counted according to the schedule independently when they were played.

3. Two figures for each team were estimated with the aim to identify the range of position changes during a competition. The considered period was from the 9th round to the end (the importance of the mentioned period is demonstrated in the results of the research). Firstly, the highest and the lowest positions of each team within the given period were estimated. The analyzed figure was an absolute value of the difference between these two positions. The second figure was the difference between the position after the 9th round and the final result. For instance, the highest position that Everton (Premier League) occupied was the 10th place while the lowest was the 17th place during the mentioned period. At the same time, the club took the 12th position after the 9th round and held the same position until the end of the league. Therefore, the difference between the highest and the lowest positions of Everton was 7 whereas the difference between the result of the 9th round and the final result was 0 positions.

Results. The results of the research are presented in the descending order of the three leagues positions in 2016–17 UEFA rankings (La Liga, Bundesliga, and Premier League). Within each league, the teams are divided into the top, middle and outsider teams and their final results are analyzed accordingly.

In La Liga (Spain), the difference between the 1st place (Real Madrid, 93 points overall) and the 7th place (Athletic Club, 63 points) was 30 points. The margin between Athletic Club and Espanyol (the 8th position, 56 points) was 7 points. The gap between the 8th (Espanyol, 56 pts) and the 17th (Leganes, 35 pts) positions constituted 21 points. At the same time, the team at the 18th place (Gijon, 31 pts) was 4 points behind the team at the 17th place. Granada at the 20th place was an outsider and obtained 20 points, which was 4.65 times lower than the result of the leader (Real Madrid).

According to the figures of Bundesliga, the gap between the leader (Bayern Munich, 82 pts) and the 7th team (Freiburg, 48 pts) was 34 points. The difference between Freiburg and Werder Bremen (the 8th place, 45 pts) was only 3 points. Moreover, the gap between Werder Bremen and Mainz (the 15th place, 37 pts) was just 11 points. The 15th and the 16th (Wolfsburg) places obtained the same number of points – 37. The outsider (Darmstadt) had 25 points; consequently, it was in 3.28 times smaller than the result of the winning team Bayern Munich.

In Premier League, the difference between the first place (Chelsea, 93 pts) and the 7th place (Everton, 61 pts) was 32 points. The gap between the 7th and the 8th (Southampton, 46 pts) places was 16 points, whereas the difference between the 8th and the 17th (Watford, 40 pts) places was only 6 points. Finally, the 18th team (Hull City, 34 pts) had 6 points behind the team that took the 17th place. The last team (Sunderland) obtained only 24 points, which was 3.9 times lower than the leader's result (Chelsea).

It is worth pointing out that the winners reached the first place of their leagues during the first part of the championships and remained at the top position during the whole second part of the tournament. The winner of La Liga (Real Madrid) held the first place after the 9th round; in England, Chelsea reached the highest position after the 12th round. The top team of Germany (Bayern Munich) was in the first place all the time except rounds 12–14.

The performed analysis determined the existence of a large gap between leaders and outsiders. Moreover, top teams obtained their highest position in the middle of the first half of the tournament and held it until the end.

Figure 1 provides information about a sum of differences (the total difference) between positions in each round of all teams and their final results. The data are available for three European championships.

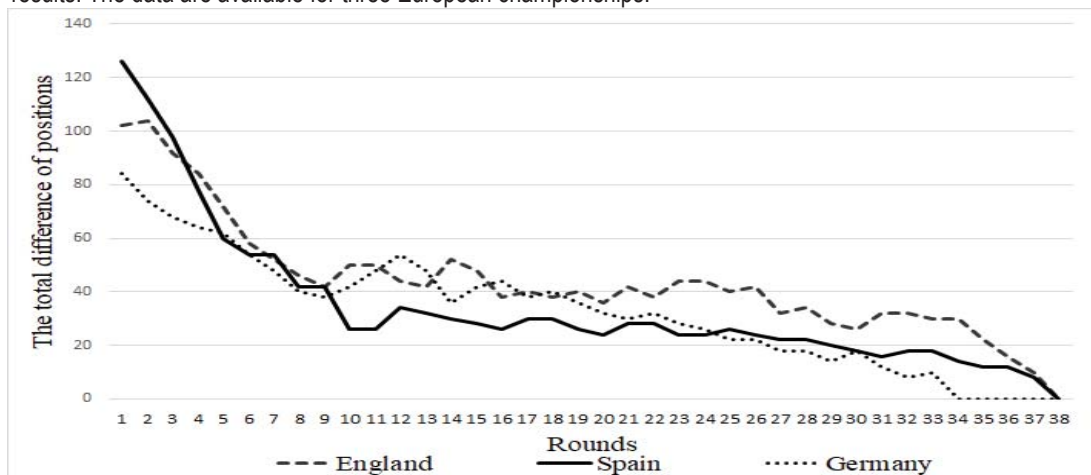


Figure 1. The total difference between the position in the current round and the final position of teams in La Liga, Bundesliga and Premier League in the 2016–17 season.

The teams of La Liga (Spain) had the largest total difference after the first round (more than 120 positions), but the number declined significantly to 26 positions after 10 rounds. The figure fluctuated within the range of about 10 positions from the 11th to the 28th rounds. The number decreased slightly from 20 positions in the 29th round to 0 position at the end.

The teams of Bundesliga (Germany) had the total difference of 84 positions after the first round. The number declined to 38 positions after the 9th round and constituted 32 positions at the end of the 22nd round. The figure gradually decreased after the 22nd round and reached 0 after the 34th round.

According to the data of Premier League (England), the total difference was just above 100 positions after the first round. However, the figure fell significantly from 104 positions after the second round to 42 positions after the 9th round. Later, the total difference fluctuated within the range of about 20 positions between the 10th and the 26th rounds. Finally, the figure decreased to 0 at the end.

The following trends can be highlighted by comparing the obtained data of the three championships. Firstly, the total number of differences decreased sharply from the start of the competition to the 9th–10th rounds. This can be partially explained by the fact that the teams were listed in the tournament table alphabetically before the first match, but not according to the previous results (e. g. of the previous season etc.). Depending on their performance in the first matches, the teams moved into the some ‘field’ (top, middle, or outsider groups) in the tournament table. The second trend is that the figures fluctuated from the 10th round to about the middle of the second half of tournaments. During this period, the average number of difference per team was 1.34 positions for Spain, 2.13 for Germany and 2.09 for England. The duration of this period was 19 rounds for Spain, 20 rounds for England and 16 rounds for Germany, which was approximately half of all the matches. Therefore, most teams managed to keep their positions during this long period. Finally, there was a slight decrease during last 5–7 matches, because some teams occupied important positions (at the top) and other teams could improve their low position and move from the outsider group to the middle group.

The performed analysis showed that about the 9th–10th rounds there occurred a turning point in the championships. As a result, the next part of the study covers the analysis of teams positions from the 9th round to the final. The purpose is to determine the two types of differences for each team within the mentioned period: A – between maximum and minimum positions, and B – between results of the 9th round and the final result (see Methods). The teams are united in several groups according to the maximum differences (changes) of positions (Table 1).

Table 1

The number of teams grouped according to the two types of difference within the period between the 9th round and the final

Top three European leagues	The ranges of position difference and the number of teams within each range							
	0–2		3–4		5–6		7 and more	
	A	B	A	B	A	B	A	B
La Liga (Spain)	7	13	7	4	5	2	1	1
Bundesliga (Germany)	3	12	7	4	5	1	3	1
Premier League (England)	2	11	7	8	3	0	8	1

According to the data of the difference between maximum and minimum positions (column A) during the mentioned period, 14 (70.0 %) teams of La Liga, 10 (55.6 %) teams of Bundesliga and 9 (45.0 %) teams of Premier League had the difference of lower than 5 positions. At the same time, only 1 (5.0 %) team of Spain, 3 (16.7 %) teams of Germany and 8 (40.0 %) teams of England had the difference of 7 and more positions.

As far as the data of the difference between the 9th round position and the final result (column B) is concerned, more than half of teams (13 teams of Spain, 12 teams of Germany and 11 teams of England) had the difference ranging from 0 to 2 positions. Only one team in each league had the difference of 7 and more positions. For the three leagues, 52 (89.7%) teams had the difference of fewer than 5 position between the results of the 9th round and the final results. The conclusion can be made that the higher a league is in the UEFA ranking, the lower its number of differences is.

Focusing on the division of the teams into top, middle and outsider team groups, the following observations have been made.

In Spain, seven top teams of the 2016–17 season obtained seven top positions after the 9th round. Moreover, during the whole period from the 10th round to the end of the tournament they were holding seven top positions, with only the 7th team (Athletic Bilbao) moving down to the 10th place once. In addition, all the outsiders (the 18th, the 19th and the 20th places) held last three positions after the 9th round.

Six of seven German top teams of the 2016–17 season occupied top six places after the 9th round, just the 7th team (SC Freiburg) was on the 8th position. The 5th and the 7th teams left the top group and moved to the 8th and the 11th places respectively within the considered period. The outsiders on the 16th and the 17th places remained in the same places after the 9th round. The 18th team (Darmstadt) was on 14th place after the 9th round.

Seven English top teams, which obtained the opportunity to play in UEFA Champions League or UEFA Europa League, reached the first seven positions in Premier League before the 10th round. However, only the 7th team (Everton) held the 9th place within the period between the 10th round and the end of the 2016–17 season. The 18th and the 20th teams were outsiders and kept the same positions both after the 9th round and at the end of the championship, and only the outsider (Middlesbrough, the 19th position) had the 17th place after the 9th round.

It is worth noting that all top and outsider teams of three analyzed leagues except one (Watford, the 17th place in Premier League) had the difference between maximum and minimum positions of fewer than five positions during the period from the 10th round to the end of tournament. Therefore, the middle teams made the greatest contribution to changing of positions in the three leagues.

Analysis of the results of the 2017–18 season showed that all 6 top teams of La Liga held top positions both after the 28th round and after the 10th round (only 5 teams after the 9th round), four of six teams of Germany held top places both after the 26th round and after the 10th round (only 4 teams after the 9th round) and 6 top teams of English Premier League were at the top 6 positions both after the 30th round and after the 10th round (only 5 teams after the 9th round).

According to the data of outsiders of the 2017–18 season, two of three outsiders is Spain and Germany after the 26th and after the 28th rounds accordingly were at outsider positions after the 10th round. Just one English outsider after the 30th round held an outsider position after the 10th round.

The analysis of the leaders position changes has revealed the following: in La Liga, Barcelona (the tournament leader after the 28th round) has been holding the 1st position since the 3rd round; in Bundesliga, the Bayern Munich (the top team after the 26th round) occupied the top place after the 10th round and has retained it; the top team of Premier League (Manchester City) after the 5th round went to the first place and has been staying there.

Therefore, the results of the 2016–17 season analysis were confirmed by the results of the 2017–18 season: the first 10 rounds is the special period of tournaments when top teams occupy the highest positions and hold them after this point to the end of the season.

Conclusion. 1. The tournaments in question can be divided into three periods. During the first period (from the start to the 10th round) the teams reach positions according to their level. The second period (from the 10th round to about the middle of the second part of the tournament) is characterized by fluctuation: the figure of position changes fluctuates slightly around a certain result. The average number of position changes is different for every league; in particular, it is 1.34 for Spain, 2.13 for Germany, and 2.09 for England. Finally, the last period (from approximately the third quarter of the tournament to the end) is completion of competitions. The number of changes decreases gradually to 0, the most places are already known and only a few major changes take place in the tournament table.

2. The top teams, which obtain the opportunity to play in European competitions, have a very high performance level. Moreover, they actively compete for the highest positions from the beginning of a tournament, occupy a top position and keep it during the whole championship. However, this statement also holds true for an outsider team which cannot win enough points in the first period and cannot change its low standing during the rest of a tournament. Only middle teams have major changes in their positions during the championships, but they were in the middle of the table. Because of it, preparation during an off-play period is of great importance.

References

1. Bampouras, T.M., Cronin, C. & Miller, P.K. (2012). Performance analytic processes in elite sport practice: An exploratory investigation of the perspectives of a sport scientist, coach and athlete. *International Journal of Performance Analysis in Sport*, 12, 468–483.
2. Barros, C. P. & Leach, S. (2006). Performance evaluation of the English premier football league with data envelopment analysis. *Applied Economics*, 38, 1149–1458.
3. Clemente F.M., Couceiro M.S., Martins F.M.L. & Mendes R.S. (2015). Using Network Metrics in Soccer: A Macro-Analysis. *Journal of Human Kinetics*, 45 (1), 123–134.
4. Coutts, A.J. (2014). Evolution of football match analysis research. *Journal of Sports Sciences*, 32(20), 1829–1830.
5. Di Salvo, V., Gregson, W., Atkinson, G., Tordoff, P. & Drust, B. (2009). Analysis of high intensity activity in premier league soccer. *Journal of Science and Medicine in Sport*, 30, 205–212.

6. Evens, T. & Lefever, K. (2011). Watching the Football Game: Broadcasting Rights for the European Digital Television Market. *Journal of Sport and Social Issues*, 35(1), 33–49.
7. James, N. (2006). Notational analysis in soccer: past, present and future. *International Journal of Performance Analysis in Sport*, 6 (2), 67–81.
8. James, N., Mellalieu, S.D., & Hollely, C. (2002). Analysis of strategies in soccer as a function of European and domestic competition. *International Journal of Performance Analysis in Sport*, 2(1), 85–103.
9. Jolly, R. (2011). Changing dynamics of the 'Big Six' in Premier League title race. *The National*. Retrieved 18 August 2013.
10. Halicioğlu, F. (2005). Can we predict the outcome of the international football tournaments? The case of Euro 2000. *Dogus Universitesi Dergisi*, 6 (1), 112–122.
11. Harrop, K., & Nevill, A. (2014). Performance indicators that predict success in an English professional League One soccer team. *International Journal of Performance Analysis in Sport*, 14(3), 907–920.
12. Hughes, M., & Franks, I. (2004). Analysis of passing sequences, shots and goals in soccer. *Journal of Sports Sciences*, 23(5), 509–514.
13. Koning, R. H., Koolhaas, M., Renes, G., & Ridder, G. (2003). A Simulation model for soccer championships. *European Journal of Operational Research*, 148 (2), 268–276.
14. Petrunin, Y. (2013). Soccerometry: a scientific direction, educational discipline. *Higher education in Russia*, 10, 97–103.
15. Mackenzie, R. & Cushion, C. (2013). Performance analysis in football: A critical review and implications for future research. *Journal of Sports Sciences*, 31(6), 639–676.
16. Michie, J. & Oughton, C. (2004). Competitive Balance in Football: Trends and Effects. *Football Governance Centre Research Paper (2)*. London, Birkbeck College.
17. Mittag, J. & Legrand, B. (2010). Towards a Europeanization of football? Historical phases in the evolution of the UEFA European Football Championship. *Soccer & Society*, 11(6), 709–722.
18. Pawlowski, T., Breuer, C. & Hovemann, A. (2010). Top clubs' performance and the competitive situation in European domestic football competitions. *Journal of Sports Economics*, 11(2), 186–202.
19. Perl, J., Grunz, A. & Memmert, D. (2013). Tactics analysis in soccer – an advanced approach. *International Journal of Computer Science in Sport*, 12, 33–44.
20. Oberstone, J. (2011) Comparing Team Performance of the English Premier League, Serie A, and La Liga for the 2008-2009 Season. *Journal of Quantitative Analysis in Sports*, 7 (1), 1–18.
21. Sarmiento, H., Marcelino, R., Anguera, M. T., Campaniço, J., Matos, N. & Leitão, J. C. (2014). Match analysis in football: a systematic review. *Journal of Sports Sciences*, 32(20), 1831–1843.
22. Smyth, R. & Ashdown J. (2010). Is the Premier League Big Four the most dominant ever? *The Guardian*. Retrieved 7 April 2010.
23. Taylor, J.B., Mellalieu, S.D., James, N. & Shearer, D.A. (2008). The influence of match location, quality of opposition, and match status on technical performance in professional association football. *Journal of Sports Sciences*, 26(9), 885–895.
24. Vrooman, J. (2007). Theory of the beautiful game: The unification of European Football. *Scottish journal of political economy*, 54 (3), 314–354.
25. Weston, M., Castagna, C., Impellizzeri, F.M., Rampinini, E. & Abt, G. (2007). Analysis of physical match performance in English Premier League soccer referees with particular reference to first half and player work rates. *Journal of Science and Medicine in Sport*, 10, 390–397.

Абдула А. Б.

Харківська державна академія фізичної культури

КОНТРОЛЬ ФІЗИЧНОЇ ПІДГОТОВЛЕНОСТІ ФУТБОЛІСТІВ НА ЕТАПІ СПЕЦІАЛІЗОВАНОЇ БАЗОВОЇ ПІДГОТОВКИ

Розглянуто зміни показників в фізичній підготовці протягом річного циклу тренувань юних футболістів. Проведено порівняльний аналіз до початку першого кола та після другого кола чемпіонату України серед юнаків 2002 р.н. Наведено аналіз літературних джерел, в яких розглядаються питання контролю фізичної підготовленості юних футболістів. У дослідженні приймали участь 28 футболістів у віці 14-15 років СК «Арсенал». Проведений аналіз дозволив прослідити динаміку по різним показникам фізичної підготовленості. Встановлено, що показники в тестуваннях фізичної підготовленості: в бігу на 10м, 15м, 50м, стрибок з місця вгору – зміни носили покращений характер ($p < 0,05$). В інших тестах достовірних відмінностей виявлено не було, але зміни в результатах прослідковуються. Погіршення показників в бігу на 30 м знизився на 0,06с (1,4%), в бігу на 100м – 0,4с (3,1%), стрибок з місця в довжину – 0,04 см (1,8%).

Ключові слова: СК «Арсенал», футболісти, фізичні показники.

Абдулла А. Б. Контроль физической подготовленности футболистов на этапе специализированной базовой подготовки. Рассмотрены изменения показателей в физической подготовке в течение годового цикла тренировок юных футболистов. Проведен сравнительный анализ до начала первого круга и после второго круга чемпионата Украины среди юношей 2002 г.р. Приведен анализ литературных источников, в которых рассматриваются вопросы контроля физической подготовленности юных футболистов. В исследовании принимали участие 28 футболистов в возрасте 14-15 лет СК «Арсенал». Проведенный анализ позволил проследить динамику по различным