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Footballers' endurance based on Berlin football teams

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Abstract

Endurance is one of the most essential motor skills in the well planned training process in football. The high intensity and pace of the game force the players to be very well prepared. The increasing requirements of the game over the years direct the attention towards the oxygen mechanisms of football players.

The aim of the study was to determine a relationship between the endurance tested by the Cooper test and the effectiveness of the game, determined by a modified method of competent referees.

The study was inclued 90 footballers of german clubs SV Berliner Brauereien, Berliner TSC and BSC Eintracht Südring Berlin. The results of studies conducted in Berlin in 2015-2018 were analysed.

Descriptive statictics were conducted: mean (X), minimum values (min), maximum values (max) and standard deviation (SD). Normal distribution was checked and correlation coefficient were determined. The results of the study were statistically analyzed in Statistica 13,3.

In the study on a bigger number of players, a statistically significant relationship was noted between the effectiveness of the game of German team players and cardio-respiratory endurance.

Keywords: training, football, aerobic motor skills

Introduction

Searching for new tactical solutions, high technical skills together with increasing game intensity, force trainers to comprehensively prepare players in tactical, mental and motor aspects (Paluszek 2003, Basiaga-Pasternak 2009, Cicirko i wsp. 2009). It is assumed that motor skills as speed, endurance, coordination or strength are essential for high effectiveness of the game. It is assumed that all the actions taken on the pitch, such as: running the ball, dribbling, passing, shots, picking up balls or moving with a change of direction, require anaerobic acid and non-lactic acid work. It may be noticed that approximately 70% ATP is produced of oxygen processes (Bangsbo 1999). As Jaskólski

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and Jaskólska (2006) wrote, it is assumed that physical capacity is an ability to make hard and long effort.

During the game there are speed-endurance and speed-strength efforts that predispose to work at high intensity (Shepard, Astrand 1992, Reilly 2007, Pilis, Pilis 2013). Therefore, it can be expected that with increasing tiredness, oxygen processes play an important role during the game. It is especially well visible with diminishing efforts of high intensity in the final quarter of the meeting (Mohr i wsp. 2003, Bradley i wsp. 2009), when teams lose goals.

Coaches describe football activities as a game of individual mistakes. Looking retrospectively, these mistakes may be caused by the lower level of training of the lack of technical skills. A longtime training is responsible for the aspect of technical and tactical prepration as well as fitness preparation (Sozański 1999). Nevertheless, it should be emphasized that the endurance has an essential meaning for shaping other motor skills.

The means, methods and forms carried out in the broadly understood training process are supposed to consciously and thoughtfully influence the development of motor skills, such as endurance or speed endurance. This is the moment when the increasing intensity of effort makes the body move into the zone of mixed effort and further towards effort with the predominance of anaerobic processes.

The research of Chmury et al. (2008) presents the legitimacy of using variable intensity training on the advantages of using the continuous method. The results of the research are identical to those of Reilly, Thomas (1976), Bangsbo (1999, 2007), Cometti (2002), who characterized the intensity of efforts in football and the variety of forms, activities with the change of pace during a football match. When analyzing the results, it can be assumed that mixed aerobic-anaerobic exercise forces players to a certain level of cardiopulmonary endurance (Kalinowski et al. 2017).

Another indicator confirming the importance of endurance in football is the distance covered on the field. Over the years, there has been a significant increase in the distance covered during the match. Initially, from a distance of 4-5 km in the 1960s to over 14 km in 2020 (Bangsbo 1999, Reilly 1997, Mohr et al. 2003, Zarzeczny et al. 2007, Bradley et al. 2009).

However, in the 2017/2018 season the German goalkeeper Manuel Neuer in a match of the Bundesliga against Sport Club Freiburg ran over 6, 5 km. (Kalinowski 2017). These trends show the legitimacy of conducting systematic research at all levels of the game in order to observe changes arising over the years. Depending on the level of the pace of the game and the requirements of the discipline, the components affecting the performance of the players will change. In order to verify, the authors in this study decided to extend previous studies that hd been conducted on a group of 22 players from the German team (Kalinowski et al. 2019).

Hence, the purpose of the work was to determine the relationship between cardiopulmonary endurance and the effectiveness of German football players.

Adequately to the aim of the study, the following research questions were formulated:

1. What level of cardiopulmonary endurance was recorded in the examined players?
2. Has the relationship between endurance and effectiveness of German football players been found?

Materials and methods

99 football players representing 5 teams from 3 German clubs: SV Berliner Brauereien, Berliner TSC and BSC Eintracht Südring Berlin took part in the research. The players were between 17 and 36 years old.

SV Berliner Brauereien was founded in 1946, Berliner Turn und Sportclub e.v. was founded in 1963, while BSC Eintracht Südring Berlin was founded in 1931. They were multi-sectional associations. Berlin clubs have raised many medalists of the Olympic Games, World and European Championships over the years. The research was carried out in Berlin in 2015 - 2018.

The level of cardiopulmonary endurance was measured using the Cooper Test, while the assessment of game effectiveness was carried out using a modified method of competent referees consisting in the quantification of qualitative actions in championship matches for quantitative data using notes awarded by five experts (Brzeziński 2005,2010; own modification). The players were rated on a scale of 1 - 6 with an accuracy of 0.5 point. The assigned note 1 had the highest value and note 6 had the lowest value, according to the German classification (scoring) system. To assess the players' actions, the following issues were qualified: passes, shots, centerings, 1x1 duels in attack and defense, working out shooting situations. Then, the principle of rejecting extreme notes was introduced, the sum of three obtained results was made and the arithmetic average was calculated. Cooper's test required competitors to cover the maximum distance in 12 minutes. As confirmed by previous studies, this test shows a high correlation with laboratory methods that check the maximum oxygen intake on a treadmill. Therefore, it is possible to estimate the cardiovascular fitness of the athlete's body and his aerobic fitness.

Standard statistical methods were used in the study. Descriptive statistics were calculated: arithmetic mean (M), standard deviation (SD), minimum values (min) and maximum values (max). Due to the ordinal nature of the variable "effectiveness of operations", the Spearman correlation coefficient was used to assess the relationship. The results were statistically processed using the Statistica 13.3 program.

Results

Based on the research, an average level of effectiveness assessment of the activities of German footballers was observed. An average result of 2.32 points was recorded. The lowest average score of a player was 5.0 and the highest average score of a player was 1.19. The average covered distance was 2,898.43 meters (Table 1). The best result obtained in the Cooper Test was 3500 meters, while the lowest result was 1450 meters (Table 1).

Tab. 1. The level of effectiveness and endurance of German footballers

	Descriptive statistics in a specific research group			
Variable	**N**	**Average**	**Minimum**	**Maximum**
Efectiveness	99	2,32	1,19	5,00
Endurance	99	2898,43	1450,00	3500,00

The average level of effectiveness assessment on the pitch of players from Berlin teams and the average level of endurance were observed. A statistically significant inverse

correlation between game efficiency and endurance measured using the Cooper Test at significance level p = 0.05 was demonstrated. The tested relationship was observed in about 54% of cases (r = -0.54). By using the German scoring criterion, it was observed that the higher the level of endurance, the higher the efficiency, presented as the lower point level (Table 2).

Tab. 2. The relationship between endurance and effectiveness in the tested group of German footballers

	Endurance vs effectiveness (p < 0,05, N=99)		
Variable	**Average**	**Stand.dev.**	**Effectiveness**
Effectiveness	2,32	0,77	1,00
Endurance	2898,43	348,79	-0,54

Discussion

Comprehensive preparation of athletes is a predictor of high sport results (Konarski, Strzelczyk 2012). Cardio-respiratory endurance plays a significant role in the training process. Thanks to it, players can perform technical and tactical activities on the pitch at a certain intensity. Currently, many research tools are used in sport to determine endurance, but the Cooper Test that we used has plenty of advantages due to its availability and ease of use (Cooper 1968). The uncomplicated procedure and cheap operation allow the use of this tool at all levels of the game (Andrasić et al. 2016, Cooper 1968). It is used both among highly trained people and among amateurs (Bandyopadhyay 2015). In the Gaetano and Rago (2014) studies, the Cooper Test was used to monitor the internal load and changes caused by new training of football players. Andrasić et al. (2016), examining 60 players at various sports levels (20 national representatives, 21 selected players and 19 players at local level), showed a statistically significant difference between the players' game and the metabolic and energy parameters that were studied. It is worth mentioning that success in sport is conditioned by many factors determining high sports results. One of them is cardiopulmonary endurance, which is not only the foundation of other motor skills, but is also noticeable through the distance covered during the game. In football, aerobic work prevails (Chmura et al. 2015), although the proportions of aerobic to anaerobic efforts differentiate players due to the position they play (Bujnovsky et al. 2015). This is also confirmed by studies of 22 junior players from the Lech Poznań club (Śliwowski et al. 2007). The authors, performing the PWC170 test, the progressive test until exhaustion, and the Multistage Schuttle Run (MST) test, showed a variation in training levels depending on the position on the pitch. Research reports on Berlin players confirm this, which explained the connection with the effectiveness of the game in more than half of the cases studied. Itconfirms the diverse function fulfilled by players on the pitch conditioned by the game system and position. Cihan et al. (2012) also obtained other performance parameters in positions in their research. The best results were obtained by footballers playing as a midfielder, which is connected to role and movement on the pitch, the worst results were obtained by goalkeepers.

On the other hand, Casaius (2002), during the season, did not notice any differentiation among Spanish footballers in his research. The threshold of anaerobic changes in the second measurement was at a higher level. Therefore, it is worth considering the next aspect of measurements depending on the duration of the season.

Interesting results were obtained in the study of Chmury et al. (2015) on 41 players of the German Bundesliga, where in the rematch round there were shorter distances covered by players during the match compared to the distances covered in the first round of the season. In the rematch round, the players did more work above the anaerobic transition threshold (Chmura et al. 2015). Assuming that players perform aerobic work for about 80% time during the match (Bujnovsky et al. 2015, Chmura et al. 2015), it is worth looking at the correlation values obtained at the level of about 54% time in the own study as satisfactory. In own research, the effectiveness assessments were carried out using a modified method of competent judges. Average level obtained by players from Berlin teams. These results confirm the results obtained in previous studies of Kalinowski et al. (2017). Based on the conducted research, it can be assumed that the level of cardiopulmonary endurance plays an important role in the broadly understood training process. The average level of endurance obtained in the research seems sufficient at this level of play. These reports confirm earlier research of the authors conducted on a group of 22 players of the German club (Kalinowski et al. 2019).

Conclusions

In response to the research questions, the following final conclusions were formulated:

1. There was a significant relationship between endurance and effectiveness of the tested players.
2. An average level of endurance was observed in the studied group of Berlin club players.
3. Endurance affects the training of players and promotes the implementation of technical and tactical tasks. Research which used the Cooper Test confirms the authors' previous reports on endurance in football.
4. To obtain full information, it is worth conducting research on players representing various levels of competition.

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