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## ASSESSMENT OF THE CORRELATION BETWEEN THE PLAYING POSITION ON THE FIELD, ACQUIRED TECHNIQUE AND THE SPECIFIC ENDURANCE OF FOOTBALL PLAYERS AT VARIOUS CALENDAR AGE

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### Keywords:

- Football,
- Technical skills,
- Specific endurance,
- Hoff-Helgerud Football,
- Endurance Test.

### Abstract:

**Introduction:** Among the key competence elements of a modern player there are an over-average level of technical skills, a stock of adaptable tactical habits, comprehensive physical fitness and motor preparation. Therefore, key roles are played by specific endurance, which is responsible for the quality and the frequency of the actions performed during the match and for the degree of the realisation of the match plan as well as by the technical preparation of the football player, which cannot be separated from the tactical preparation.

The aim of the work was to define the correlation between specific endurance and technical preparation of two groups of football players: juniors and seniors.

**Material and methods:** The study covered two groups of football players from the Podkarpacie region: 10 juniors from an Athletic Championship School and 10 seniors from lower leagues. Body mass and body height of the players were measured and their acquired technique was assessed by means of a questionnaire and the 5-level Likert scale. For the assessment of specific endurance the Hoff-Helgerud Football Endurance Test was used. The data were processed by means of the Mann-Whitney test, Spearman's rank correlation coefficient and the chi-square independence test.

**Results:** The study did not show differentiation of the football players depending on the playing position and their calendar age; no correlation was found for the whole group between specific endurance and acquired technique.

**Conclusions:** The correlation between specific endurance and acquired was observed only in the junior group.

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## INTRODUCTION

In order to manage the process of football training properly, one has to consider current developmental tendencies in that discipline. Among the key competence elements of a modern player there are an over-average level of technical skills, a stock of adaptable tactical habits, comprehensive physical fitness and motor preparation, a high level of decision making processes, speed of action and a high level of position-related specialisation, complemented

with the versatility of action, a high internal motivation and a strong psyche [Dorna et al. 2016]. In a football match, a professional player covers on average a distance of between 10 to 13.5 km, over 90% of which consists of the forms of activity of a low and medium intensity, and the remaining part is constituted by activities of the submaximal or maximal intensity [Barros et al. 2017; Andrzejewski et al. 2012; Andrzejewski et al. 2018]. Hoff et al. [2002], while describing the specificity of training in football, claim that in professional football most of the training is devoted to the improvement of the aerobic endurance of the players. Not always, however, does football training meet the criterion of effective endurance training, the main purpose of which is the improvement of the maximum oxygen uptake, preparing the player for the performance of physical activity of the intensity of 90-95% of the maximum frequency of heart beats lasting from three to eight minutes. In football, specific endurance is often identified with speed endurance, which is the ability of performing and repeating quick sprints during the match without a noticeable deterioration of their quality [Zub 2009]. For football players, the most important thing is the efficient performance of technical and tactical tasks without disturbance in the functioning of the central nervous system. That is possible when the player achieves a high tolerance to local tiredness and muscle acidosis with the optimal level of anaerobic endurance [Bangsbo 1999]. In football, specific endurance is responsible for the quality and the frequency of actions performed during the match and the degree of realisation of the match plan. That concerns not only individual, but also team tasks [Stępiński, Paluszek 2011]. The degree of specific endurance depends, to a large degree, on the level of acquired technique of the player. A low level of technical preparation contributes to the loss of energy during the performance of motor activities during the match as well as to the increase in tiredness and causes difficulties in the appropriate and quick control of the ball. Technique in football is considered as one of the most difficult ones among team sport games due to the fact that specialised actions are performed mostly with the lower limbs [Paluszek 2010]. Technique in football is described as the ability of free and effective performance of all motor activities with and without the ball, with the purpose of efficient execution of sport combat under specified circumstances [Talaga 2006]. Technical preparation of the football player is the basic element of the training, but it cannot be separated from the tactical preparation. It must serve the premise of the game and go hand in hand with fitness training [Bednarski, Koźmin 2004].

### **Aim of the work**

The aim of the work was to define the correlation between specific endurance and technical preparation of two groups of football players: juniors and seniors.

The following research questions were asked:

1. How do specific endurance and specific technique look, with regard to the age group?
2. How do specific endurance and the assessment of technique acquisition look, depending on the playing position and with regard to the age group?
3. Is there a correlation between the acquired technique of the players covered by the study and their specific endurance?

### **Material and methods**

The study covered two groups of football players from the Podkarpacie region: juniors from an Athletic Championship School and seniors from lower leagues.

The assessment of body mass was made with the use of the medical scales with the precision of 0.01 kg and body height was measured with the anthropometer. The assessment of acquired technique of the players was performed with the use of a questionnaire and the five-level Likert scale [1932], where 1 means a very weak mark (the lowest) and 5 is a very good mark (the highest); the information about the players' playing positions on the field was

also obtained. For the assessment of specific endurance, the Hoff-Helgerud Football Endurance Test [2003]– a physical fitness test – was used. The route of the test consisted of a 290-metre-long lap, which the player covered with the ball, performing the following elements of the football game: dribbling the ball, slalom between cones, jumps over a hurdle, change in the pace of the run (acceleration and slowing down) and a backwards run. The test lasted 8 minutes during which the player was supposed to cover as many laps (distance) as possible. Before the test, performed on a grass football field, the players had a 15-minute warm-up.

The assessment of the significance of the differences in the specific endurance between the two groups was presented by means of the Mann-Whitney test. For the analysis of the exact correlation between the age and the specific endurance, Spearman’s rank correlation coefficient was used. The comparative analysis of the acquired technique was performed by means of the chi-square independence test.

**Results**

The study covered 20 players training football: 10 in the junior and 10 in the senior category. The distribution of the group is presented in table 1.

Table1. Characteristics of the study group.

Somatic features	Age category									
	Junior					Senior				
	$\bar{x}$	Me	S	Min	Max	$\bar{x}$	Me	S	Min	Max
Body height [cm]	173.5	172.5	5.2	165	182	179.3	179.5	4.9	173	189
Body mass [kg]	63.8	64	3.4	57	69	71.7	73	5.4	62	78
BMI	21.2	21.3	0.7	19.6	22.0	22.3	22.0	1.3	20.2	24.6

A comparative analysis was made of the acquired technique of the juniors and the seniors. Table 2 presents the distribution of the technique assessment of both groups of players. The assessment of the significance of the differences between the two groups was made by means of the chi-square independence test. In the senior group there are relatively more players with the technique mark at a good level, but with such small samples this difference cannot be considered to be fully reliable. The test probability value p, established by means of the independence test, significantly exceeds 0.05, which means that there are no grounds to claim that the seniors’ technique is significantly better than that of the juniors.

Table 2. Technique assessment in both groups.

Technique level	Age category (p = 0.5244)		Total
	Junior	Senior	
Weak	3 (30%)	2 (20%)	5 (25%)
Medium	6 (60%)	5 (50%)	11 (55%)
Good	1 (10%)	3 (30%)	4 (20%)
Total	10	10	20

The same analysis could be also conducted while considering detailed values of age, making use of Spearman's rank correlation coefficient (figure 1). The scatter diagram shows the value of the correlation coefficient together with the assessment of its statistical significance. The value of the scatter diagram marker varied depending on the number of people sharing a given combination of age and technique level.

However, that analytical approach did not allow us to determine the existence of a clear correlation between the age and the technique level either. Even though the correlation coefficient is positive ( $R = 0.34$ ), given the lack of statistical significance of the results obtained, generalisations beyond the test group cannot be made.

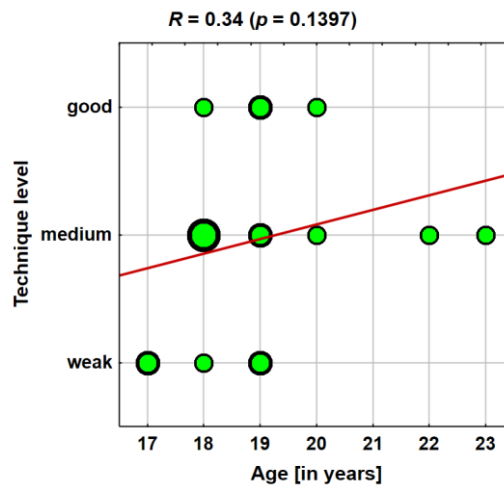


Figure 1. Age vs. technique level.

A comparison was made of the technical training in the groups created on the basis of the playing position on the field. Table 3 below shows the results of the analysis for all 20 players. On the basis of the chi-square independence test results, the existence of the correlation between the playing position and the technique cannot be determined. A small size of the test group does not allow for drawing binding generalisations; on the other hand, at the level of the tested group, it is worth noticing that among the defenders there is relatively the highest number of players with a weak technique, and among the midfielders – with a good one.

Table 3. Correlation between the playing position and the acquired technique.

Technique level	Playing position ( $p = 0.4365$ )			Total
	Defender	Midfielder	Forward	
Weak	3 (43%)	1 (11%)	1 (25%)	5
Medium	3 (43%)	5 (56%)	3 (75%)	11
Good	1 (14%)	3 (33%)	0 (0%)	4
Total	7	9	4	20

A similar analysis was also carried out with regard to the age group. This arrangement did not allow for statistically significant correlations between the playing position on the field and the technique level either (due to the small number of members in the groups being compared, the chi-square independent test in its exact version – for small samples was used in the analysis). The correlation between the playing position on the field, with regard to the age, and the technique level can be seen in table 4. Among the defenders there is the highest number of players with a weak technique, and among the midfielders – with a good technique.

Table 4. Correlation between the playing position on the field, with regard to age, and technique level.

Technique level	Age category					
	Junior			Senior		
	Playing position ( $p = 0.6071$ )			Playing position ( $p = 0.4762$ )		
	Defender	Midfielder	Forward	Defender	Midfielder	Forward
Weak	2 (40%)	0 (0%)	1 (50%)	1 (50%)	1 (17%)	0 (0%)
Medium	3 (60%)	2 (67%)	1 (50%)	0 (0%)	3 (50%)	2 (100%)
Good	0 (0%)	1 (33%)	0 (0%)	1 (50%)	2 (33%)	0 (0%)

p – test probability value calculated by means of the chi-square independence test in the version for small samples.

The analysis of the correlation between age and specific endurance was made from two perspectives – in the dichotomic division into the junior and the senior groups and for the exact values of the players' age. The results of the specific endurance test in both age groups were processed with the use of the Mann-Whitney test (in the exact version for small samples) and there are no grounds to claim the difference in the level of specific endurance between the groups of juniors and seniors, which has been presented in table 5.

Table 5. Correlation between age and distance covered.

Age category	Distance [m]				
	$\bar{x}$	Me	S	Min	Max
Junior	1491	1510	136	1295	1695
Senior	1456	1457.5	157	1242	1700
<i>p value</i>	0.6842				

The analysis of the correlation between the calendar age and the specific endurance required the use of Spearman’s rank correlation coefficient. The results are presented in figure 2, which shows the value of the correlation coefficient together with the assessment of its statistical significance. There are no grounds to claim the existence of the statistically significant correlation between age and specific endurance.

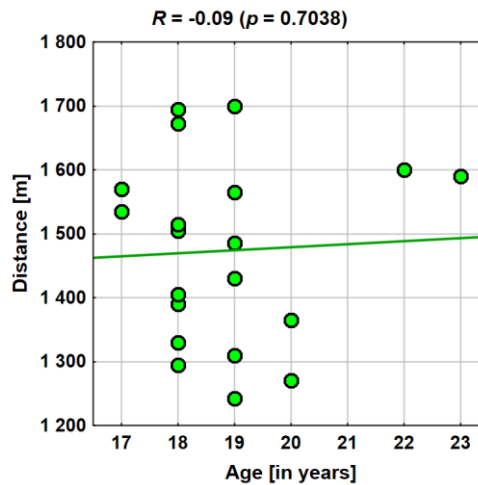


Figure 2. Age vs. distance.

For the assessment of the significance of the differences between the three groups of players, the Kruskal-Wallis test was used (table 6). At the level of the whole test group, regardless of the age of the players, no correlation can be found between the level of acquired technique and the specific endurance. The mean distance covered in the endurance test is almost identical in the groups created on the basis of the level of acquired technique.

Table 1. Correlation between technique and distance covered.

Technique level	Distance [m]				
	$\bar{x}$	Me	S	Min	Max
Weak	1490	1535	163	1242	1672
Medium	1469	1485	128	1295	1695
Good	1466	1447.5	201	1270	1700
<i>p value</i>	0.9544				

By means of Spearman's rank correlation analysis, in table 7 the level of technique was correlated with the specific endurance, with regard to the division into the junior and senior groups. The results are interesting – it appears that in the junior group, the people with a better technique have a lower specific endurance. In the senior group there is no such correlation between technique and endurance.

Table 2. Correlation between technique and specific endurance.

Correlation results analysis	Age category		
	Junior	Senior	Total
	Distance [m]		
Technique level	-0.64 (p = 0.0471*)	0.36 (p = 0.3042)	-0.06 (p = 0.8041)

The results have been also presented in the form of a scatter diagram (figure 3), in which the values of the correlation coefficient were presented together with the assessment of its statistical significance.

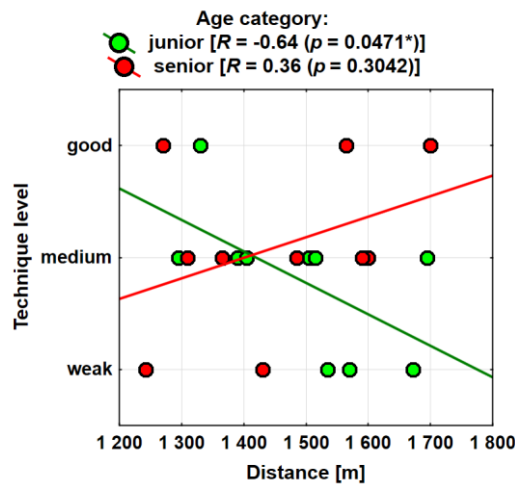


Figure 3. Distance vs. technique level.

The playing position on the field does not differentiate in a statistically significant way the specific endurance. The mean distance covered in the three compared groups of players is almost identical (table 8).

Table 8. Correlation between playing position on the field and specific endurance.

Playing position on the field	Distance [m]				
	$\bar{x}$	Me	S	Min	Max
Defender	1475	1430	173	1270	1695
Midfielder	1466	1485	144	1242	1700
Forward	1488	1525	123	1310	1590
<i>p value</i>	0.9583				

An analogous analysis has also been made with regard to the division into age groups (table 9). The groups constructed in that way were very small. Certain differences can be noticed in the distance covered, however there are no grounds to consider them statistically significant.

Table 9. Correlation between playing position on the field with regard to age and specific endurance.

Playing position on the field	Distance [m]					
	Age category					
	Junior			Senior		
	$\bar{x}$	Me	S	$\bar{x}$	Me	S
Defender	1524	1570	176	1350	1350	113
Midfielder	1413	1405	88	1493	1525	167
Forward	1525	1525	14	1450	1450	198
<i>p value</i>	0.4526			0.5589		

The results have been presented in the graphic form in figure 4, which shows the mean and the 95% confidence interval for the average distance in particular age groups and the groups constituted on the basis of the playing position on the field.



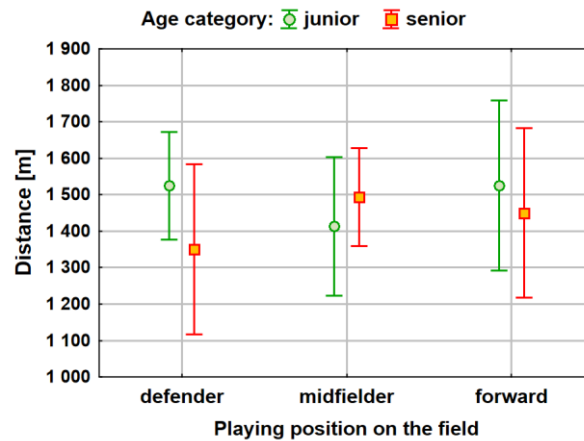


Figure 4. Correlation between playing position on the field with regard to age and specific endurance.

## Discussion

Both specific endurance and acquired technique play a very important role in the training of each football player. Both of these skills are shaped in the training process from the earliest years in order to obtain the highest possible level of the young player's performance [Turner & Stewart, 2014]. The results of specific endurance obtained by the players tested in this study are contained within 1200 and 1500m, which corresponds to  $VO_2max.$  at the level below 48-58 ml/kg/min. and constitutes low values as compared to 60 ml/kg/min. observed by Mohr et al. (2003) and 55–67 ml/kg/min., by Davis et al. [1992]. This study did not reveal differentiation of endurance depending on the playing position on the field, similarly to the studies by Al-Hazzaa et al. [2001], which did not show such a differentiation among highly qualified football players either. They are contrary to the study of Dellal et al. (2010), which did notice such correlations. It seems that there is an obvious correlation between the specific endurance, which is characterised by the performance of long-term work with the ball and the acquired technique. Numerous studies conducted by, among others, Polczak [2013] showed a significant correlation between the time in which the maximum power is upheld and the accepted assessment of the general sports level. Other studies, by Rampinini et al. [2009], showed that the players from the best clubs of the Italian Serie A perform more work with the ball during their matches of the maximum and submaximum intensity than other players from lower-ranked teams. In our studies, discussed above, no correlation was found between specific endurance and acquired technique while considering the whole test group. The one that was observed, though, was that in the junior group, the athletes with a better technique have a better specific endurance, which can be the effect of the unfinished development of the aerobic endurance  $VO_2max.$  The level of this

parameter attains its maximum around the age of 20 [Fortuna 2008]. It could be also suspected that players with a weaker technique compensate for it with better motor preparation. That correlation was not observed among the seniors, where the players with a better acquired technique and a worse acquired technique obtained very similar results. Considering the whole group, however, regardless of the age of the studied players, no correlation between specific endurance and acquired technique can be stated.

## Conclusions

1. Specific endurance does not vary significantly with regard to the age category; in the junior category the results are similar to those from the senior category.
2. A subjective assessment of the acquired technique in the groups of juniors and seniors does not allow for a clear claim about the correlation between age and acquired technique. In the senior group there is a relatively higher number of players whose technique is at a good level.
3. With regard to the playing position on the field, the players obtained a comparable distance in the test, which does not allow a statement of correlation.
4. The correlation between specific endurance and acquired technique was observed only in the junior group, where the players with a better technique obtained a lower result in the test. For the whole group this correlation is not noticeable. It seems justifiable, therefore, to claim that neither the juniors nor the seniors playing in lower leagues are well enough prepared for the participation in the competition at a higher level, yet. It is recommended that in the selection process not only the trials diagnosing the level of particular skills and the preparation of the player should be considered, but, most of all, comprehensive tools, one of which undoubtedly being the football-specific Hoff-Helgerud Football Endurance Test.

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