

A COMPARATIVE ANALYSIS OF THE RESULTS OBTAINED BY GROUPS OF FOOTBALL GOALKEEPERS

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Abstract. *The apparent simplicity of the football game and the relatively small number of rules make this sport very easy to implement in any social environment. The goalkeeper position has become of utmost importance in the modern game of football. Nowadays, the goalkeeper's technical skills are much more diversified, and the requirements for courage, commitment, vision and coordination are essential. The purpose of the present study is to highlight the differences between the goalkeepers of three junior football teams in anthropometric terms but also according to the results recorded when testing their motor skills. To identify these differences and verify the effect of belonging to a group on the studied dependent variables (squats, standing vertical jump, sit-ups, standing long jump), different methods can be used. Given that the research sample consisted of a small number of participants, the Kruskal-Wallis H test was used. This non-parametric test is based on the comparison of medians. However, the H test does not specify between which groups of goalkeepers (sports clubs) there are significant differences or not. In order to find out between which of the three investigated groups there are significant differences, they were compared two by two with the help of the Mann-Whitney U test (which is also based on the comparison of medians). The results are discussed in the context of their implications for coaches, physical trainers and sports managers.*

Keywords: *football, goalkeepers, sports clubs.*

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Introduction

The development of training methods specific to the goalkeeper's game together with the increase of this player's physical skills and understanding of the tactical game have the role of consolidating the importance of the goalkeeper within the team. The major transformations that have recently occurred in the tactical strategies of the teams also involve a highly varied game of the goalkeeper, from the duty of defending the goal area to the technical ability of participating in the team's construction game.

It has been found that the overall performance of a goalkeeper is closely related to the level of competition in which their team is involved and the level of football expression of

their teammates; thus, a goalkeeper is able to solve increasingly difficult situations “as their level of competition increases” (Seaton & Campos, 2013, p. 314).

The game of football requires many physical, technical and tactical skills (Dellal et al., 2011). All these need to be monitored and tested periodically through specific tests. It is in the interest of both the coach and the athlete to regularly monitor the results of training programmes (Polidoro et al., 2013). Field tests provide results specific to the sport, complementing the laboratory tests; “tests are generally carried out at the start and end of the pre-season period to evaluate the effectiveness of specific training interventions” (Svensson & Drust, 2005, p. 601). Referring to elite adolescent players, Ré et al. (2014) state that “anthropometric characteristics and isolated skills do not predict match-related technical performance and should be used with caution for talent identification or training purposes” (p. 482). Careful and correct planning of physical exercise is of maximum importance to prevent muscle fatigue at the time of testing. Specialists should also pay special attention to the level of mental fatigue as a dimension that allows reaching peak performance in sport (Pelin et al., 2020). During a pandemic (such as COVID-19), multidisciplinary team members need to be aware of athletes’ stress levels and coping strategies (Makarowski et al., 2022), which will influence their on-field performance.

Coaches have a huge influence on the physical and psychological development of the athletes they train (Short & Short, 2005; Gustafsson et al., 2017; Barcza-Renner et al., 2016; Predoiu et al., 2020), which is why their professional background is very important. Goalkeeper coaches believe that four skills are essential for a professional football goalkeeper, namely: “decision-making skills, athleticism, mentality, and technical skills” (Otte et al., 2019, p. 1465). Rodríguez-Arce et al. (2019) emphasise that “coaches do not have to focus only on the goalkeepers’ physical training (motor skills), but they should also consider developing the reaction time (cognitive skills)” (p. 655).

Perez-Arroniz et al. (2021) conducted a review of the scientific literature on the football goalkeeper to find specific information about this position on the field and managed to outline the following profile for this player:

- “the sprint, the jump, the agility, and the mobility are factors that determine the performance of the goalkeeper;
- the goalkeepers are less likely to be injured than the field players, but there are certain typical injuries in the position that must be protected by a proper way of strengthening and technique.” (p. 1)

The following common features have been described for the football goalkeeper training system (Cojocar, 2002):

- physical training is limited to the specifics of the goalkeeper position;
- technical training: with the team through ball games (5 against 2, shuttle, small-sided games); with the group of goalkeepers; 1 against 1 with the goalkeeper coach for difficult elements or identified weaknesses;
- tactical training is entirely subordinated to the team;
- psychological training is achieved individually and in groups.

A special move for a goalkeeper is making a diving save; to perform it perfectly and secure the ball, “it is important to develop the goalkeeper’s body for making contact with the

ground” (Machnik, 2013, p. 60). In the case of a side jump, goalkeepers perform a rolling motion to reduce their hip loading (Schmitt et al., 2009).

The coach needs to highlight horizontal lateral skills and exercises (for example, sideways push-off, sideways jumps) with an emphasis on “pushing-off with the contralateral leg when training and assessing goalkeeper’s physical performance” (Ibrahim et al., 2018, p. 313).

The typical training of goalkeepers includes “an excess of accelerations/decelerations and a lack of running actions performed at high metabolic loads” (Moreno-Perez et al., 2019, p. 19).

During a football match, the goalkeeper is likely to face the most difficult moment of the game: the penalty kick. The penalty kick might have a decisive impact on a football game due to the opportunity for a team to change the score, and this moment is even more important in the case of shootouts (Buscà et al., 2022). The chances of defending a shot largely depend on both the goalkeeper’s reaction when the ball leaves the opponent’s foot and the correct choice of the direction to which the ball is sent. Fariña et al. (2013) believe that another important factor is the ball speed. Also, “the goalkeepers who took a step forward and stood up while the striker approached the ball had the best save and miss ratios” (Hughes & Wells, 2017, p. 55).

Both biologists and behavioural analysts have indicated a strong genetic component in performance of team sports such as football; at the same time, the influence of systematic training and development programmes should not be overlooked. Specialised studies have a considerable support role in the processes of monitoring and educating talented football players “towards realizing their potential” (Williams & Reilly, 2010, p. 657).

Purpose. This study aims to compare anthropometric data and motor characteristics obtained from three independent groups of goalkeepers belonging to three professional football clubs in Romania. Therefore, the research purpose is to highlight the differences between goalkeepers in anthropometric terms but also according to the results recorded when testing their motor skills.

Research question: What are the differences between the goalkeepers of the three football teams in anthropometric terms but also according to the results recorded when testing their motor skills?

Methodology

Participants

The research participants are 16 junior football goalkeepers aged 17-18, who are registered with three sports clubs in Romania and have a competitive experience between 7 and 9 years.

The goalkeepers are distributed as follows:

- the group of goalkeepers from ACS Olympic, which includes four players;
- the group of goalkeepers from FC U Craiova 1948, which includes six players;
- the group of goalkeepers from CSM Rm. Vâlcea, which includes six players.

Procedure

The investigated goalkeepers were asked to make two attempts for each tested motor skill and the best result was taken into account.

The motor skills chosen to test the 16 young goalkeepers were the following:

- squats (number of squats performed within 30 seconds);
- standing vertical jump;
- sit-ups (number of sit-ups performed within 30 seconds);
- standing long jump.

Full confidentiality of the data and anonymity of the participants were ensured, and ethical principles were respected.

Quasi-experimental design

In our study, the independent variable is defined by the existence of the three groups of goalkeepers (belonging to three Romanian sports clubs). The dependent variables are the results of both anthropometric measurements (height, bust height, palm length, foot length) and tested motor skills (squats, vertical jump, sit-ups, standing long jump).

Results

Given that the research sample consists of a small number of participants, the Kruskal-Wallis H test will be used. This non-parametric test is based on the comparison of medians (the median is the statistical value that divides a series of ordered values into two equal parts). Application of the Kruskal-Wallis H test requires compliance with the following conditions: the dependent variable must be quantitative, and the research samples must be small; each participant must be included in only one group, and the groups must be independent (Labăr, 2008).

An overview of the anthropometric data collected from the goalkeepers of the three sports clubs participating in the study indicates that the medians are sensibly close (Table 1).

Table 1. Dynamics of median values according to club membership

Club	Height	Bust height	Palm length	Foot length
ACS Olympic (1)	184.50	74.50	21.00	27.50
FC U Craiova (2)	179.50	77.50	20.00	29.00
CSM Rm. Vâlcea (3)	184.00	74.50	21.00	29.00

Table 2 shows the average rank values, which are differentiated by club membership for each group of goalkeepers included in the research and determined using the SPSS program.

Table 2. Average rank values according to the studied variable and club membership

Club	Height	Bust height	Palm length	Foot length
ACS Olympic	12.25	6.25	9.63	5.00
FC U Craiova	3.50	11.83	5.33	9.67
CSM Rm. Vâlcea	11.00	6.67	10.92	9.67

Note: Data obtained by applying the Kruskal-Wallis H test

Table 3 shows the value of the Kruskal-Wallis H test (Chi-Square), the degrees of freedom (df) and the statistical significance threshold (Sig.).

Table 3. Test statistics: Anthropometric indicators

	Height	Bust height	Palm length	Foot length
Chi-Square	11.130	4.905	5.581	3.636
df	2	2	2	2
p	.004	.086	.061	.162

For the “Height” variable, belonging to one of the three clubs generates significant differences. For the other variables, belonging to a sports club does not influence the values because the significance threshold is greater than 0.05.

However, the H test does not specify between which clubs there are significant differences or not. In order to find out between which of the three investigated groups there are significant differences, we will have to compare them two by two with the help of the Mann-Whitney U test. The application conditions remain the same as for the Kruskal-Wallis U test. Given that the Mann-Whitney U test is non-parametric, it involves comparing the medians of the two clubs under research.

To find out between which of the three clubs there are significant differences, the significance threshold was adjusted based on the Bonferroni method (see, for example, Urzeală et al., 2014) according to the number of comparisons (three, in our study: ACS Olympic vs. FC U Craiova, ACS Olympic vs. CSM Rm. Vâlcea and FC U Craiova vs. CSM Rm. Vâlcea) as follows: $\text{Sig.} = 0.05/3 = 0.0167$.

Table 4. Test statistics: ACS Olympic vs. FC U Craiova

	Height	Bust height	Palm length	Foot length
Mann-Whitney U	0.00	3.000	6.000	5.000
Wilcoxon W	21.00	13.000	27.000	15.000
Z	-2.582	-1.955	-1.414	-1.620
Asymp. Sig. (2-tailed)	.010	.051	.157	.105
Exact Sig. [2*(1-tailed Sig.)]	.010	.067	.257	.171

Comparing the anthropometric variables of the goalkeepers from the ACS Olympic and FC U Craiova clubs (Table 4), it can be seen that the significance threshold is higher than 0.0167, which indicates that the differences are not significant for the following variables: bust height, palm length and foot length. The only variable that shows significant differences is height ($p = 0.010$). The effect size is $r = 0.81$, highlighting a very large difference between

the results (for the effect size interpretation, see Predoiu, 2020).

Table 5. *Test statistics: ACS Olympic vs. CSM Rm. Vâlcea*

	Height	Bust height	Palm length	Foot length
Mann-Whitney U	9.000	12.000	10.500	5.000
Wilcoxon W	30.000	33.000	20.500	15.000
Z	-.685	0.000	-.395	-1.620
Asymp. Sig. (2-tailed)	.494	1.000	.693	.105
Exact Sig. [2*(1-tailed Sig.)]	.610	1.000	.762	.171

According to Table 5, none of the anthropometric variables recorded for the two clubs (ACS and CSM) shows significant differences: $p > 0.0167$. Even if there are differences, they are statistically insignificant.

Table 6. *Test statistics: FC U Craiova vs. CSM Rm. Vâlcea*

	Height	Bust height	Palm length	Foot length
Mann-Whitney U	0.000	7.000	5.000	18.000
Wilcoxon W	21.000	28.000	26.000	39.000
Z	-2.918	-1.790	-2.373	0.000
Asymp. Sig. (2-tailed)	.004	.073	.018	1.000
Exact Sig. [2*(1-tailed Sig.)]	.002	.093	.041	1.000

There are situations in which the result of the Kruskal-Wallis U test does not indicate significant differences between clubs, although the two-by-two analytical comparisons made with the help of the Mann-Whitney U test may reveal significant differences between the clubs under research. Regarding height, significant differences are found (Table 6), taking into account the significance threshold adjusted using the Bonferroni method. The effect size is $r = 0.84$, which highlights a very large difference between the results.

Table 7 shows information regarding the median values obtained in motor tests by each club and the 16 goalkeepers.

Table 7. *Dynamics of median values according to motor tests and club membership*

Club	Squats	Vertical jump	Sit-ups	Standing long jump
ACS Olympic	30.0	35.5	28.5	2.38
FC U Craiova	26.0	29.5	25.0	2.26
CSM Rm. Vâlcea	23.5	30.5	24.5	2.25
Overall median	27.5	31	25	2.295

It is noted that there are differences between the research participants in terms of club membership. Thus, the average rank is higher for the ACS Olympic goalkeepers compared to those from FC U Craiova and CSM Rm. Vâlcea, and therefore their results are better.

Table 8 shows the results of the Kruskal-Wallis H test as regards the existence or non-existence of significant differences between the four variables, starting from the proposed motor tests.

Table 8. Results of the Kruskal-Wallis H test for motor skills

	Squats	Vertical jump	Sit-ups	Standing long jump
Chi-Square	6.612	7.304	6.375	6.518
df	2	2	2	2
p	.037	.026	.041	.038

The significance threshold for the four variables related to motor skills shows values below 0.05, which suggests that belonging to one of the three clubs generates significant differences.

In order to see which differences are significant, we will use the Mann-Whitney U test that involves grouping the clubs two by two. The results of the Mann-Whitney U test (for each of the three pairwise comparisons) reveal that there are significant differences for a significance threshold of 0.016 (Table 9).

Table 9. Test statistics: ACS Olympic vs. FC U Craiova

	Squats	Vertical jump	Sit-ups	Standing long jump
Mann-Whitney U	1.000	.500	1.000	3.000
Wilcoxon W	22.000	21.500	22.000	24.000
Z	-2.374	-2.459	-2.382	-1.919
Asymp. Sig. (2-tailed)	.018	.014	.017	.055
Exact Sig. [2*(1-tailed Sig.)]	.019	.010	.019	.067

For the vertical jump, significant differences are recorded between the goalkeepers trained by ACS Olympic and those from FC U Craiova ($r = 0.75$). There are also important differences in squats and sit-ups.

Table 10. Test statistics: ACS Olympic - CSM Rm. Vâlcea

	Squats	Vertical jump	Sit-ups	Standing long jump
Mann-Whitney U	2.000	1.500	2.500	0.000
Wilcoxon W	23.000	22.500	23.500	21.000
Z	-2.152	-2.245	-2.038	-2.558
Asymp. Sig. (2-tailed)	.031	.025	.042	.011
Exact Sig. [2*(1-tailed Sig.)]	.038	.019	.038	.010

A comparison between ACS Olympic and CSM Rm. Vâlcea indicates that there are significant differences in the standing long jump test ($r = 0.80$), while for the other tests, the differences are within the 0.05 threshold (Table 10).

Table 11. Test statistics: FC U Craiova vs. CSM Rm. Vâlcea

	Squats	Vertical jump	Sit-ups	Standing long jump
Mann-Whitney U	17.500	15.500	15.500	18.000
Wilcoxon W	38.500	36.500	36.500	39.000
Z	-.081	-.402	-.409	0.000
Asymp. Sig. (2-tailed)	.936	.687	.683	1.000
Exact Sig. [2*(1-tailed Sig.)]	.937	.699	.699	1.000

Between FC U Craiova and CSM Rm. Vâlcea, the differences are statistically insignificant, which is emphasised by the high significance thresholds (Table 11).

Discussion and Conclusion

In order to correctly assess a goalkeeper's skills and performance, a comprehensive analysis is needed, which includes not only motor skills but also technical/tactical skills, as well as the player's efficiency related to the number of matches played and the actual play time. Also, both subjective and objective assessments can be used concurrently when making decisions about the promotion of football players (Dugdale et al., 2020).

The purpose of junior championships is to "raise" the future members of the senior team in one's own organisation so as to avoid (as much as possible) the fee-based acquisition of players from outside the club by transfer. For this reason, the results of the present study are of interest to athletes, coaches, physical trainers and sports managers. The data in this paper can also be an important reference factor in the assessment of junior football goalkeepers.

From the analysis carried out, it appears that the ACS Olympic goalkeepers have significantly better results compared to the other athletes in terms of the investigated motor skills. This finding derives from the non-parametric tests used, whose p values are below the 0.05 threshold. The results can be the basis of a thorough analysis regarding the training methods and means used by goalkeepers with lower motor performance.

In the case of anthropometric variables, even if there are differences, they are not significant for three out of the four studied variables: bust height, palm length and foot length. As regards height, the difference is significant and in favour of the ACS Olympic club. "Research has suggested that a soccer player's anthropometric dimensions can be a major determinant for success within a playing position." (Hencken & White, 2006, p. 205)

Anthropometric and physiological criteria play an important role "as part of a holistic monitoring of talented young goalkeepers" (Reilly et al., 2010. p. 669). The greatest satisfaction of a goalkeeper coach is the promotion of their most skilled players to high performance. Correct testing, relevant analysis and careful monitoring throughout the competitive year enable the coach to make the most correct decision, with a high degree of objectivity. A new strength training method (the 3/7 protocol) has the effect of stimulating muscle growth through mechanical tension, accumulation of metabolites and lack of oxygen (Stragier et al., 2019).

It is known that too high levels of stress and anxiety have a negative impact on athletes, affecting their intersegmental coordination, topographical memory and reaction time (Cojocaru et al., 2015a), which is directly related to on-field performance and testing situations (Cojocaru et al., 2015b). Therefore, further studies are needed to investigate the effect of various psychological variables (and their level of manifestation) on the motor performance of larger samples of football players and goalkeepers (the main limitation of the current research being the small number of goalkeepers investigated).

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Informed Consent Statement: The participants provided their written informed consent to participate in this study.

Data Availability Statement: Data are available upon request to the contact author.

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