



## ORIGINAL ARTICLE

# Analysis of individual performance indicators of football goalkeeper

Alberto Tienza-Valverde<sup>a</sup>, Víctor Hernández-Beltrán<sup>a,\*</sup>, Mario C. Espada<sup>b,c,d</sup>,  
Alfredo Bravo-Sánchez<sup>e</sup>, Fernando J. Santos<sup>b,c,f</sup>, José M. Gamonales<sup>a,e</sup>

<sup>a</sup> *Facultad Ciencias del Deporte, Universidad de Extremadura, 10005, Cáceres, España*

<sup>b</sup> *Instituto Politécnico de Setúbal, Escola Superior de Educação, 2914-504 Setúbal, Portugal*

<sup>c</sup> *Life Quality Research Centre (CIEQV-Leiria), 2040-413 Rio Maior, Portugal*

<sup>d</sup> *CIPER, Faculdade de Motricidade Humana, Universidade de Lisboa, 1499-002 Lisboa, Portugal*

<sup>e</sup> *Facultad de Ciencias de la Salud, Universidad Francisco de Vitoria, Ctra. Pozuelo-Majadahonda Km 1,800, 28223, Pozuelo de Alarcón, Madrid, España*

<sup>f</sup> *Faculdade de Motricidade Humana, Universidade de Lisboa, 1499-002 Lisboa, Portugal*

Received 17 March 2023; accepted 26 June 2023

Available online 11 July 2023

## KEYWORDS

Sport;  
Notational analysis;  
Game actions;  
Training

**Abstract** One of the most widely used strategies for performance analysis in different sports is notational analysis through direct observation of technical-tactical actions, which allows to understand the main indicators of sporting performance of the players, both individually and collectively. Football goalkeepers (GKs) are involved in the game differently when compared to the rest of the players in the team and, therefore, they develop different high-level and high-intensity tactical-technical actions. Therefore, the present work aimed to analyse the different performance indicators of football GKs through a search in the following databases: Web of Science (WOS), Scopus (Elsevier), PubMed (NIH) and, SPORTDiscus (EBSCO), until February 2023. The following keywords were used: "Football" or "Soccer", "Goalkeeper" and "Performance analysis". The results show that the main performance indicators are the percentage of avoided goals, the distribution of the ball at the goal kick as well as the number of offensive and defensive actions. Therefore, training sessions should be planned and implemented aiming to improve these skills.

© 2023 CONSELL CATALÀ DE L'ESPORT. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introducción

One of the most widely used strategies for performance analysis in different sports is notational analysis through direct observation of the technical-tactical actions of athletes during training sessions or competitions.<sup>1-3</sup> In addition, the use of inertial devices has recently been implemented, as they allow the quantification and control

\* Corresponding author at: Facultad de Ciencias del Deporte. Universidad de Extremadura, Cáceres, España.

E-mail address: [vhernandpw@alumnos.unex.es](mailto:vhernandpw@alumnos.unex.es) (V. Hernández-Beltrán).

of training and competition loads, as well as identifying the physical demands of the players.<sup>4</sup> This whole process will allow the coaching staff to obtain data regarding the sporting performance of the team and, specifically, of the players, as well as to provide feedback to the athletes through notational analysis,<sup>5,6</sup> to improve technical-tactical situations.<sup>7,8</sup>

Performance indicators are a combination of actions that describe the performance aspects of a sport, presenting a direct link to success in matches, final ranking, and medal winning.<sup>3</sup> Therefore, knowledge related to performance indicators will provide the coaching staff with information regarding the strengths and weaknesses of the players and the team,<sup>9</sup> through a qualitative and quantitative approach, as well as allowing to identify and extract relevant data on technical-tactical behaviours.<sup>10</sup> On the other hand, the knowledge of performance indicators will allow the creation of an ideal performance profile, which must be developed to present a high performance level.<sup>7</sup> Furthermore, a good analysis of performance indicators can make a difference at the sporting level.

This analysis has been carried out in different sports modalities. Football is the most studied sport worldwide, for this reason, goal-scoring opportunities,<sup>11</sup> ball possession,<sup>12,13</sup> and shots on goal<sup>14</sup> have been analysed as the main performance indicators in professional football teams. Therefore, the variables that differentiate winning and losing teams are shots on goal, the number of successful passes, as well as the quality of defensive and attacking actions in the game, with winning teams presenting the best values.<sup>15</sup> In addition, match results can be influenced by the location (home or away), and by the ranking of the team.<sup>16</sup> On the other hand, due to the Covid-19 pandemic, these indicators have been influenced, with an increase in free kicks, and a decrease in yellow cards, tackles, and attacks.<sup>17</sup> However, studies related to sporting performance indicators in football goalkeepers (GKs) are scarce.

However, football GKs have a different involvement in the game compared to other players in the team and perform different high-level and high-intensity tactical-technical actions,<sup>18</sup> which can directly and decisively influence the rhythm and direction of the team,<sup>19</sup> and result of the football game. Consequently, research has focused on the analysis of the offensive and defensive tactical-technical actions of GKs,<sup>20,21</sup> to find out the main performance indicators of GKs, depending on the level of the team<sup>22</sup> and the final result of the competitive match.<sup>23</sup> In addition, the pedagogical variables that influence the design of training tasks for GKs<sup>24</sup> have been . From a defensive point of view, the action of the football GKs focuses on defending the goal, to prevent goalscoring by the opposition team.<sup>25</sup> On the contrary, in the offensive process, the GK is fundamental in the construction of the attack<sup>26</sup> and is influenced by different conditioning factors of the visiting team, such as high pressure.<sup>27</sup>

Therefore, given the scarcity of specific research related to the study of individual performance indicators in different sports,<sup>16</sup> the main objective of this study was to analyse the main specific performance indicators of football GKs through a compilation of documents from different databases.

## Material and method

### Design

This study is framed within the *Theoretical Studies*.<sup>28</sup> A "Process of compilation and selection of studies" was carried out, aiming an update, comparison, and critical analysis of theories or models in a specific field,<sup>29</sup> to identify and analyse the documents related to the performance indicators of football GKs, to update the knowledge related with this topic.

### Criteria for study selection

To select as many manuscripts as possible related to the subject of the study, a series of inclusion and exclusion criteria were established (Table 1).

### Search strategy

For the search of documents, *Web of Science (WOS)*, *Scopus (Elsevier)*, *PubMed (NIH)*, and *SPORTDiscus (EBSCO)*, databases were used. The search was conducted in the four databases, using the keywords, "Football" or "Soccer", "Goalkeeper" and "Performance analysis", in which 256 manuscripts were collected, up to February 2023. To reduce the bias of the identified papers, the search process was carried out by two different researchers (VH-B and JMG). Both results were merged, and the previous inclusion and exclusion criteria were applied. In case of disagreement, a third expert was consulted to obtain agreement (MCE). A total of 12 documents related to the subject of the study were included. A systematic review methodology was used, which is in full swing in the field of Sports Sciences due to being an agile and easy-to-use method, as well as allowing researchers to classify the documents according to specific variables<sup>30</sup> Fig. 1 shows the flow diagram related to the search procedure used.

**Table 1** Inclusion and exclusion criteria for selecting documents related to the topic.

N.º	Inclusion criteria
1	Select any type of scientific document.
2	Describe any variable related to the analysis of the GKs (minimum 50 words).
3	To be written in English, Spanish, or Portuguese, because they are the main languages of the scientific divulgation.
4	Full text or Abstract available.
<i>Exclusion criteria</i>	
1	Documents where only the keywords entered in the database are mentioned.
2	Studies that cannot be referenced.
3	Documents that cannot be classified according to Sports Science disciplines.
4	Manuscripts related to the analysis of outfield football players actions.

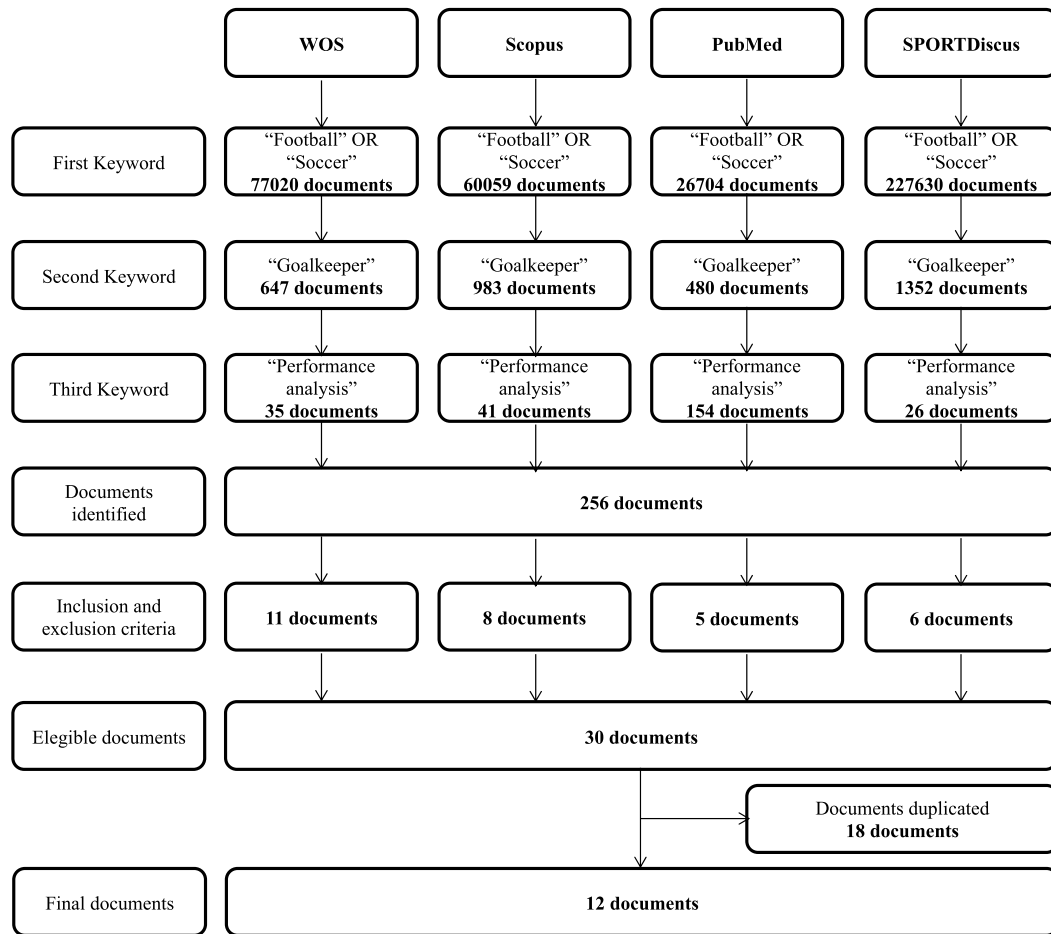


Fig. 1 Flow chart of the search.

### Variable codification

The manuscripts selected for the study sample were classified based on different variables. Different guidelines established by previous researchs were followed.<sup>31</sup> Also, to increase the analysis of the documents and extract more relevant results about the object of study, a series of subject-specific variables and variables for the analysis of the methodological quality of the manuscripts have been specified. This will allow researchers to carry out an exhaustive analysis of the different documents.

- General Variables: Author/s, Year, Title y Main purpose.
- Specific variables of the documents: Keywords, Type of document, Database, Type of study, Sample 1, Sample 2, and Sport Science discipline.
- Specifics variables related to the topic: Instruments used, Actions studied, Variables analysed, and performance indicators.
- Methodological quality variables of the studies: Quality of the documents.

### Registration procedure for studies

A procedure for registering and classifying studies previously used in the field of Sports Sciences has been carried out, as

it is an easy, flexible, and agile methodology for its development.<sup>30</sup> It allows the classification of the documents according to the different variables selected by the authors.<sup>31,32</sup> In the same way, this process is characterized by the development of a series of phases, as this is one of the most important premises when carrying out a systematic review of the literature.<sup>33</sup> Fig. 2 shows the phases that have been followed.

Phase 5, corresponding to the analysis of the methodological quality of the documents, was performed based in the Law et al.<sup>34</sup> questionnaire. For the evaluation of each of the documents, a process of selection of external experts was carried out, who had to meet a series of inclusion criteria associated with knowledge of the review topic:

- 1) To have doctoral degree in Sports Sciences.
- 2) To have knowledge and experience in training for football GKs (minimum 5 years).
- 3) To be a football coach (level 1, 2, and/or 3).

Firstly, a total of ten experts were selected to perform the evaluation process. After implementing the inclusion criteria, the number of experts was reduced to six. The level of voluntariness of each of the experts for participation was considered. A process of training and familiarization with the questionnaire was carried out, to increase the reliability

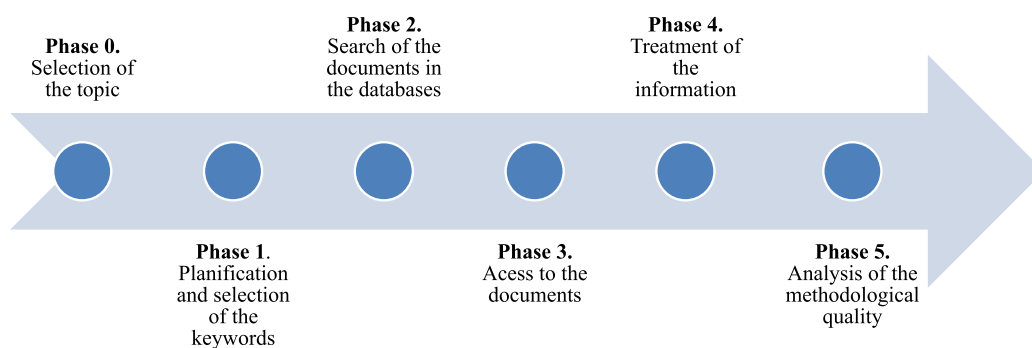


Fig. 2 Phases followed in the search procedure.

of the scores to be made. This training and reliability procedure had four stages<sup>35</sup>: 1) Preparatory stage, 2) Selection stage of the coders, 3) Training stage of the observers and, 4) Reliability stage. Finally, an analysis of intra-observer reliability ( $p = 1.0$ ), and inter-observer reliability ( $p = 0.93$ ) was performed. This reduced the risk of bias in the scores, as well as brought greater reliability and validity to the process of evaluation. After scoring the manuscripts, a score was given to each paper based considering the average of the scores given by the experts, thus obtaining its methodological quality<sup>36</sup>:

- Excellent methodological quality (A), scores upper than 75.
- Good methodological quality (B), scores between 51 and 75.
- Low methodological quality (C), scores lower than 50.

### Statistical analysis

To determine the reliability between the different observers and the scores a reliability analysis was performed. Multi-rater Kappa free<sup>37</sup> index was used, to find out if the experts assessed equally. The value of 1.0 was the most reliable reference.<sup>38</sup> The software used for the analysis was the Statistical Package for the Social Science (v27, 2021, IBM SPSS, Armonk, NY, USA).

### Results

The documents selected are shown in Table 2 according to the general and specific variables of the documents and to the specific variables related to the topic and the methodological quality variable (Table 3).

### Discussion

This study aimed to compile a collection of documents related to the study of individual performance indicators in football GKs, to understand the main actions and variables of the study, as well as the instruments used to analyse the different game situations. The results of the systematic review highlight that there are few documents related to the study of the technical-tactical actions of football GKs. The main indicators of individual performance in GKs are

offensive actions (short ball movements, long ball movements, etc.), defensive actions (blocks, deflections, clearances, etc.), actions related to physical preparation (sprint, the intensity of movement, distance covered, impacts, etc.), and actions related to psychological requirements (attention and concentration routines, patterns for penalties, etc.). In football, the GK is the key player in initiating attacking and defensive plays.<sup>24,25</sup>

Regarding the databases, most of the studies are indexed in WOS ( $n = 11$ ), as it is one of the platforms with the largest number of scientific documents. All of them have been published in scientific journals, using theoretical studies ( $n = 1$ ), or empirical studies with quantitative methodology ( $n = 11$ ), in which 66% of the manuscripts have been published after 2018. In the scientific literature, we did not find previous documents with the same results as ours, however, it can be affirmed that the GK actions are determinant in the offensive and defensive process of a football team.<sup>21,27</sup> Therefore, research related to GKs in football is a topic of recent interest by researchers, mainly focused on the analysis of training and competitive information, to comprehensively analyse the main performance indicators of GKs.

Considering the instruments used for data collection and coding, a great diversity of devices was observed to evaluate sports performance in football GKs. Sainz de Baranda et al.,<sup>39</sup> and Liu et al.<sup>22</sup> use the OPTA SportData Spain Company Software (Madrid), to extract the data from the game statistics, and performed the analysis. In the same way, publicly accessible websites are used for data extraction, such as the website of the Spanish Football Federation,<sup>40</sup> or using television recordings.<sup>41</sup> This great diversity of tools for the identification and extraction of data shows the great possibility that exists to carry out the analysis of game actions without the need to carry out the development and validation of valid and reliable instruments using the Delphi method, as this will require an indispensable amount of time.<sup>42</sup> To analyse and present the most up-to-date possible data, it is recommended to use the gambling statistics that are publicly available on official platforms.

In terms of the analysed actions, there is a predominance of analysis of technical-tactical actions in a defensive situation.<sup>19,20,23</sup> Specifically, saves,<sup>40,43</sup> the movements of GKs during penalty kicks,<sup>44,45</sup> and the distribution and effectiveness of passes at the goal kick<sup>46</sup> have been previously analysed. For the analysis of the previous actions, different variables have been evaluated depending on the approach to the problem and the objectives defined in each of the

**Table 2** General and specifics variables of the documents.

Id	Author/s Year	Title	Main purpose	Keywords	TD	DB	Type of study	S1 & S2	SCD
1	Gavião, Gavião, Sant'Anna, Lima, & Garcia (2021)	Performance analysis of professional soccer goalkeepers by composition of probabilistic preferences	The study aimed to assist managers and technical committees in the selection of professional football GKs by analysing performances in matches over two seasons, considering three criteria: goals conceded per minute played, percentage of goals saved, and percentage of matches in which the GK did not concede goals.	Soccer; Evaluation; Goalkeepers; Composition of Probabilistic Preferences	JA	Scopus	Quant.	Yes. 64 GKs.	Coaching Science. Sport Information.
2	Mikikis et al. (2021)	Goalkeeper performance: Analysis of goalkeepers' contribution to their team's build-up under the opponent's pressure in the 2018 World Cup	The study aimed to analyse technical and tactical aspects of the 2018 FIFA World Cup focusing on the offensive actions of male GKs when under pressure, and to assess whether their actions correlated with the outcome of the match.	Soccer; Goalkeepers; offense; Build-Up; Passes	JA	Scopus	Quant.	Yes. 41 GKs.	Coaching Science. Sport Information.
3	Sainz de Baranda et al. (2019)	Differences in the offensive and defensive actions of the goalkeepers at women's FIFA World Cup 2011	This study aims to analyse the differences between the offensive and defensive actions of GKs, and to identify if there is a relationship with the ranking of their teams in the respective leagues.	Women's Football; match statistics; notational analysis; performance indicators; soccer	JA	SPORTDiscus	Quant.	Yes. 20 GKs.	Coaching Science. Sport Information.
4	kolbinger & stöckl (2019)	misbehaviour during penalty	This study aims to provide empirical	Trivial offenses; Rule violations;	JA	Scopus, WOS	Quant.		Coaching Science.

**Table 2** (Continued)

Id	Author/s Year	Title	Main purpose	Keywords	TD	DB	Type of study	S1 & S2	SCD
		kicks and goalkeepers holding the ball too long as trivial offenses in football	evidence for the existence of infringements. Furthermore, it allows to describe the respective patterns related to the technical-tactical actions of football GKs.	Football; Penalty kicks; Six-second rule				Yes. 458 hands ball & 618 penalty kicks.	Sport Information.
5	Serrano et al. (2019)	The team's influence on physical and technical demands of elite goalkeepers in La Liga: a longitudinal study in professional soccer	This study aimed to analyse the evolution of the physical and technical demands of elite GKs in different teams of the Spanish First Division of Professional Football.	Soccer; Goalkeeper; Performance analysis; Match demands; Team's level	JA	Scopus, SportDiscus	Quant.	Yes. 127 GKs.	Coaching Science. Sport Information.
6	Jara, Ortega, Gómez & Sainz de Baranda (2018)	Effect of pitch size on technical-tactical actions of the goalkeeper in small-sided games	This study aimed to determine how the size of the pitch influenced the GKs technical and tactical actions when playing in confined spaces.	Performance analysis; Soccer; Tasks	JA	Scopus, SportDiscus, WOS	Quant.	Yes. 13 football players (3 GKs).	Coaching Science. Sport Information.
7	Lames (2018)	Chance involvement in goal scoring in football – an empirical approach	This study aimed to examine the impact of chance in football using the case of the goal.	Performance analysis; Bundesliga, Premier League	JA	Scopus, WOS	Quant.	Yes. 875 goals in the Bundesliga & 1056 in the Premier League	Coaching Science. Sport Information.
8	West (2018)	A review of the key demands for a football goalkeeper.	This study aimed to collect data on the demands and performance keys of GKs.	Soccer; Goalkeeper; Demands; Skill; Physical characteristics,	JA	Scopus, SportDiscus, WOS	TS	NS.	Coaching Science. Sport Information.
9	Vicente-Vila & Lago-Peñas (2016)	The goalkeeper influence on ball possession	The present study aimed to identify the impact of playing 4 vs.	Performance analysis; Offensive	JA	SportDiscus, WOS	Quant.	Yes. 326 situations with the ball.	Coaching Science.

Table 2 (Continued)									
Id	Author/s Year	Title	Main purpose	Keywords	TD	DB	Type of study	S1 & S2	SCD
10	Liu et al. (2015)	effectiveness in futsal  Match performance profiles of goalkeepers of elite football teams	4 or 5 vs. 4 on possession effectiveness in futsal and to determine the best predictors of possession effectiveness. The aim of the study was to examine the match performance of elite GKs considering three situational variables (opposition, result, and location).	performance; Logistic regression; Goalkeeper  Football association; Performance analysis; Soccer; Analytic Sport	JA	Scopus, Sport-Discus, WOS	Quant.	Yes. 46 GKs.	Sport Information.  Coaching Science. Sport Information.
11	Padulo, Haddad, Ardigò, Chamari, & Pizzolato (2015)	High frequency performance analysis of professional soccer goalkeepers: a pilot study	The study aimed to examine the match performance of elite GKs considering three situational variables (opposition, outcome, and location).	Athletic performance; Athletes; Physical exertion	JA	Scopus, WOS	Quant.	Yes. 10 GKs.	Coaching Science. Sport Information.
12	Seaton & Campos (2011)	Distribution competence of a football clubs goalkeepers	This study aims to increase the understanding of the distribution of GK performance by analysing the performance of GKs playing at different levels.	Distribution; Goalkeeper; Football; Success; Performance	JA	Scopus, Sport-Discus, WOS	Quant.	Yes. 4 GKs.	Coaching Science. Sport Information.

Id: Item of the documents; TD: Type of documents; DB: Database; S1: Sample 1; S2: Sample 2; SSD: Sport Science Discipline; JA: Journal Article; Quant.: Empirical study with quantitative methodologic; NS: No specified, TS: Theoretical study.

Table 3 Specifics variable related to the topic and quality variable.					
Id	Instruments used	Studied actions	Studied variables	Performance indicators	Quality
1	Eeb FBref.com	GKs saves and goals conceded.	Goals conceded per minute played in the season, Percentage of goals prevented by the GK, Percentage of games in which the GK does not concede goals.	Goals conceded per minute played in the season, Percentage of goals prevented by the GK, Percentage of games in which the GK does not concede a goal.	A
2	Sport Scout	Defensive technical-tactical actions of the goalkeeper and actions with the ball by the goalkeeper.	Actions of GKs when they have the ball at their feet and are under pressure (passing or dribbling an opponent), actions of GKs when they have the ball at their feet without being under pressure from the opponent, and the defensive actions of GKs, i.e. saves, clearances, blocks, deflections, blocks, blocks, starts, stopping a shot that prevents the opponent from scoring (caught or blocked with the body) and also throwing, when the GK passes the ball to a teammate or starts a shot. attack by throwing the ball under or over the head.	Distribution of the ball from the goal kick. Number of successful passes, closely related to the good performance of the team and teammates. Defensive technical actions. .	A
3	Statistics were extracted from OPTA Sportsdata Spain Company software (Madrid)	For the analysis, different variables of the GKs tactical-technical actions related to offensive and defensive situations are taken into account.	Offensive actions (type of pass and the passing zone). Defensive actions (goals and shots conceded, types of saves, and, basic GK actions).	Number of offensive actions (the higher the number of actions, the better the performance). Passing effectiveness in different zones of the area.	B
4	Sportradar	Penalties and GKs with the ball in their hands.	GK, match location, minute, previous action, current score.	Time the GK keeps the ball in his hands.	B
5	MediaCoach	All physical and technical actions of the GK.	Distance travelled (m), sprint distance (m), number of sprints, the total number of passes, successful passes, percentage of successful passes (%), balls recovered, balls lost, the ratio of balls lost: balls recovered, and number of saves.	Sprint distance (m), number of sprints, percentage of successful passes (%), number of saves.	B
6	Ad hoc observation tool	Saves, flying, exits, clearances, 1 × 1, shovelling, blocks, defence clearances, passes with the hand, passes with the foot, goal kicks, shots.	Area of play, playing time, offensive actions of the GK (technical attacking actions, length, direction, area of the football pitch from where the shots were taken), defensive actions of the GK (technical defensive actions, intervention zone of the GK).	Number of defensive actions performed (blocks, deflections, clearances).	B
7	Television broadcasts		The playing situation was classified as both open play and set	Not specified.	B



Table 3 (Continued)

Id	Instruments used	Studied actions	Studied variables	Performance indicators	Quality
8	Not specified	Corner kicks, free kicks, and actions that end in goals.  Defensive actions, GK technique (catching a shot, high crosses, deflections, positioning, strikes, one-on-one situations), GK intervention zone, foot control, passes, and clearances.	pieces, such as corners, free kicks, and penalties. Match time was characterized with six 15-minute intervals and injury time. Rankings were recorded from the perspective of the scoring team and with the number of goals scored so far. The location of a match (home or away) was recorded, as well as the ranking of the scoring and receiving teams in the final table of the season.  Physical demands, match analysis, distribution, technical demands, psychological demands, and training implications.	Intensity of movement, distance covered, speed, stops, passes, serves, reaction time.	B
9	Observational data notation	Attacks with equal numbers and superiority.	Effectiveness of ball possession, goalkeeper involvement, duration of possession, passes used, number of players involved, defensive pressure, defensive density, end zone, match status, and match location.	Number of effective passes in attacking situations. Technical skills when taking the ball out of the penalty area.	B
10	Statistics were extracted from the OPTA Sportsdata Spain Company software (Madrid).	Offensive and defensive technical-tactical actions with the ball.	Qualities of the team and its opposition (high, medium, and low level team), Result of the match (win, draw, and loss), Location of the game (home and away).	Touches of the ball, passing, passing accuracy, passing to the top half, passing accuracy to the top half, fouls conceded, interceptions, clearances, fouls committed, yellow cards, tackles, recoveries, saves, blocks, dropped balls.	B
11	Two synchronized high-speed digital cameras (Casio Exilim FH020 High-Speed, 210 Hz) and Dartfish 5.5 Pro-motion software (Dartfish, Fri-bourg, CH) to analyse the video sequences.	GKs movements	Number of front-lateral actions (left and right) with the distance travelled (speed in the first last metre), and the number of changes of direction, as well as the total distance travelled.	Speed of movement, and speed of reaction during shots at goal.	B
12	Video camera and DVD	GK distribution	Zones, type, frequency, and effectiveness of ball distributions.	Effectiveness of ball distributions.	B

A: Excellent methodological quality; B: Good methodological quality.

studies. The main variables are those actions in which the GKs intervene with the ball in play, for example, when having to pass or kick.<sup>46,43</sup> Also, actions without the ball have been previously analysed, such as movements before contacting the ball or at the moment of contacting.<sup>45,23</sup> There is a relationship between the actions and the analysed variables, as there are similarities between them. It is recommended that more research related to the subject under study can be carried out in the future because it is essential to understand in detail the technical-tactical interventions of the GKs during training sessions and matches, as well as when the team plays as a home or away team. With this information, it will be possible to envision which aspects are more important to work and develop in the GKs training process. Consequently, it is necessary to perform more research associated to the understanding of all the actions that influence the sporting performance of the football GK.

In relation to the performance indicators, relationships are established between the percentages of saves and goals conceded with the effectiveness of the GKs actions.<sup>23</sup> In addition, indicators connected with physical demand also emerge, such as the number of sprints,<sup>20</sup> the distance covered,<sup>19</sup> or the speed of movement.<sup>45</sup> On the other hand, the number of saves, whether they are blocks, clearances, or rejections,<sup>22</sup> the efficiency in passing,<sup>46</sup> or the possession of the ball by the GK<sup>47</sup> are available as indicators. Knowledge of GK indicators in football facilitates the analysis and the design of training sessions by the coaching staff. It is essential to analyse all the technical-tactical actions involved in the sporting performance of the GK in football, and even to study the variables related to anticipation and reduction of movement time.<sup>48</sup> For this reason, it is recommended that the number of publications related to the performance indicators of football GKs can be increased to broaden knowledge and improve the preparation of GKs.

Finally, in terms of the methodological quality of the documents, it should be noted that 83% of the documents have a good methodological quality since they obtained an average score of between 50 and 75. The studies by Gavião et al.<sup>40</sup> and Mikikis et al.<sup>23</sup> were of excellent methodological quality. This process enables to identify and reduce the risk of bias in the results obtained in the studies. It is also recommended that different tools can be used to analyse this factor, such as the PEDro scale,<sup>49</sup> the MINORS scale,<sup>50</sup> or the CERT scale.<sup>51</sup> The type of design carried out in each of the documents, randomized controlled, comparative studies, and related to the study of the proposed intervention, respectively, can also be considered.

## Conclusions

Performance indicators allow us to comprehensively understand those aspects or skills that describe the aspects related to the performance of a sport, and which are directly linked to success. GKs in football are considered the last man to defend a shot on goal, influencing goalscoring, or not, and, consequently, the final result of the match of football. Therefore, identifying the main performance indicators of GKs is of vital importance for the coaching staff of football teams to project which skills or GK actions are

needed to be improved during training, the enhance performance in the match of football.

The main performance indicators of football GKs are characterized by the fact that they contribute to the positive development of different tactical-technical offensive and defensive actions. In addition, aspects such as the distribution and effectiveness of short and long passes, the ability to hold the ball at the feet, as well as the number of effective shots and saves made are considered. Training sessions should improve these skills, because they will have a negative influence on individual and team performance..

Regarding the limitations of the study, it is worth highlighting the scarcity of literature regarding performance indicators in football GKs, who are responsible for the last possibility to avoid goalscoring by the opposition team in a game of football. In the future, it is recommended to carry out new studies to analyse the sporting performance indicators of GKs, and, consequently, to be able to design specific training tasks for the improvement and development of these aspects, aiming an improvement in the performance of GKs, which will directly influence the overall performance of the team.

## Informed consent of study participants

The review study was conducted in accordance with the ethical provisions of the Declaration of Helsinki (2013), and in compliance with the guidelines of Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016.

## Agradecimientos y financiación

El trabajo se ha desarrollado dentro del Grupo de Optimización del Entrenamiento y Rendimiento Deportivo (GOERD), de la Facultad de Ciencias del Deporte, de la Universidad de Extremadura. Todos los autores han contribuido en la realización del manuscrito y certifican que no ha sido publicado ni está en vías de consideración para su publicación en otra revista. Además, Este trabajo ha sido parcialmente subvencionado por la Ayuda a los Grupos de Investigación (GR21149) de la Junta de Extremadura (Consejería de Empleo e Infraestructuras); con la aportación de la Unión Europea a través de los Fondos Europeos de Desarrollo Regional (FEDER). Los autores Fernando J. Santos y Mário C. Espada son apoyados por Instituto Politécnico de Setúbal y Foundation for Science and Technology I.P., Grant /Award Number UIDP/04748/2020. Además, el autor José M. Gamales es beneficiario de una Ayuda del Programa de Recualificación del Sistema Universitario Español, Campo de Conocimiento: Biomédico (Ref. de la Ayuda: MS-18).

## Conflicts of interest

The authors do not indicate any conflict of interest. In addition, it should be noted that none of the authors have contributed to the contamination of the scores contamination of the scores given by the different experts for the

assessment of the the evaluation of the methodological quality of the selected studies of the selected studies.

## Confidentiality of data

The authors declare that no patient data appear in this article.

## References

- Silva A, Sánchez F, Garganta J, Anguera MT. Patrones de juego en el fútbol de alto rendimiento. Análisis secuencial del proceso ofensivo en el campeonato del mundo Corea-Japón 2002. *Cultura, Ciencia y Deporte*. 2005;1(2):65–72.
- Barreira D, Casal CA, Losada JL, Maneiro R. Observational methodology in sport: performance key elements. *Front Psychol*. 2020;11(596665), <https://doi.org/10.3389/fpsyg.2020.596665>.
- Hughes MD, Bartlett RM. The use of performance indicators in performance analysis. *J Sports Sci*. 2002;20(10):739–54, <https://doi.org/10.1080/026404102320675602>.
- Ibáñez SJ, Piñar MI, García D, Mancha-Triguero D. Physical fitness as a predictor of performance during competition in professional women's basketball players. *Int J Env Res Public Health*. 2023;20(2):988, <https://doi.org/10.3390/ijerph20020988>.
- O'Donoghue P. Principal components analysis in the selection of key performance indicators in sport. *Int J Perf Anal Sport*. 2008;8(3):145–55, <https://doi.org/10.1080/24748668.2008.11868456>.
- Taylor JB, James N, Mellalieu SD. Notational analysis of corner kicks in the English premier league. In: Reilly T, Cabri J, Araújo D, eds. *Science and Football V*, Eds, Routledge; 2005. p. 656, <https://doi.org/10.4324/9780203412992>.
- O'Donoghue P. *Research Methods for Sports Performance Analysis*. London: Routledge; 2010.
- Krusinskiene R, Skarbalius A. Handball match analysis: computerized notation system. *Ugdymas, Kunokultura, Sportas*. 2002;3(44):23–33.
- Gamonales JM, León K, Jiménez A, Muñoz-Jiménez J. Sport performance indicators in football 7-a-side for people with cerebral palsy. *Rev Int Med Cien Act Fís Dep*. 2019;19(74):309–28, <https://doi.org/10.15366/rimcafd2019.74.009>.
- Hughes MD, Franks I. *The Essentials of Notational Analysis*. An introduction. Nueva York: Routledge; 2008.
- Tenga A, Holme I, Ronglan LT, Bahr R. Effect of playing tactics on goal scoring in Norwegian professional soccer. *J Sports Sci*. 2010;28(3):237–44, <https://doi.org/10.1080/02640410903502774>.
- Collet C. The possession game? A comparative analysis of ball retention and team success in European and international football, 2007–2010. *J Sports Sci*. 2013;31(2):123–36, <https://doi.org/10.1080/02640414.2012.727455>.
- James N, Mellalieu SD, Hollely C. Analysis of strategies in soccer as a function of European and domestic competition. *Int J Perf Anal Sport*. 2002;2(1):85–103, <https://doi.org/10.1080/24748668.2002.11868263>.
- Lago-Peñas C. Ganar o perder en el fútbol de alto nivel. ¿Una cuestión de suerte? *Motricidad: Eur J Human Mov*. 2005;14:135–50.
- Lago-Peñas C, Lago-Ballesteros J, Rey E. Differences in performance indicators between winning and losing teams in the UEFA Champions League. *J Hum Kinet*. 2011;27:135–46, <https://doi.org/10.2478/v10078-011-0011-3>.
- Sarmento H, Marcelino R, Anguera MT, Campaniçoo J, Matos N, Leitão JC. Match analysis in football: a systematic review. *J Sports Sci*. 2014;32(20):1831–43, <https://doi.org/10.1080/02640414.2014.898852>. 2014.
- Fernández-Cortés J, Gómez-Ruano MA, Mancha-Triguero D, Ibáñez SJ, García-Rubio J. Evolution of performance indicators in soccer during the last decade. *Appl Sci*. 2022;12(24):12834, <https://doi.org/10.3390/app122412834>.
- Otte FW, Millar SK, Klatt S. How does the modern football goalkeeper train? – an exploration of expert goalkeeper coaches' skill training approaches. *J Sports Sci*. 2020;38(11–12):1465–73, <https://doi.org/10.1080/02640414.2019.1643202>.
- West J. A review of the key demands for a football goalkeeper. *Int J Sports Sci Coach*. 2018;13(6):1215–22, <https://doi.org/10.1177/1747954118787493>.
- Serrano C, Paredes-Hernández V, Sánchez-Sánchez J, Gallardo-Pérez J, Da Silva R, Porcel D, Colino E, et al. The team's influence on physical and technical demands of elite goalkeepers in LaLiga: a longitudinal study in professional soccer. *Res Sports Med*. 2019;27(4):424–38, <https://doi.org/10.1080/15438627.2018.1555755>.
- Santos FJ, Santos J, Espada M, Ferreira C, Sousa P, Pinheiro V. T-pattern analysis of offensive and defensive actions of youth football goalkeepers. *Front Psychol*. 2022;13:957858, <https://doi.org/10.3389/fpsyg.2022.957858>.
- Liu H, Gómez MA, Lago-Peñas C. Match performance profiles of goalkeepers of elite football teams. *Int J Sports Sci Coach*. 2015;10(4):669–82, <https://doi.org/10.1260/1747-9541.10.4.66>.
- Mikikis D, Michailidis Y, Mandroukas A, Mavrommatis G, Metaxas T. Goalkeeper performance: analysis of goalkeepers' contribution to their team's build-up under the opponent's pressure in the 2018 world cup. *Cent Eur J Sport Sci Med*. 2021;34(2):77–86, <https://doi.org/10.18276/cej.2021.2-07>.
- Gamonales JM, León K, Muñoz-Jiménez J. Relación entre la presencia del portero y las variables pedagógicas que define las tareas en el fútbol. Un estudio de caso. *MHSalud*. 2021;18(1):1–14, <https://doi.org/10.15359/mhs.18-1.4>.
- Santos J, Sousa PM, Pinheiro V, Santos FJ. Analysis of offensive and defensive actions of young soccer goalkeepers. *Hum Mov*. 2022;23(1):18–27, <https://doi.org/10.5114/hm.2021.104183>.
- Shafizadeh M, Davids K, Correia V, Wheat J, Hizan H. Informational constraints in interceptive actions of elite football goalkeepers in 1v1 dyads during competitive performance. *J Sports Sci*. 2015;34(17):1596–601, <https://doi.org/10.1080/02640414.2015.1125011>.
- Santos FJ, Brito B, Rodrigues B, Ferreira B, Pereira C, Ferreira C, et al. Análise observacional das ações dos guarda-redes de futebol jovem. *Cuad Psicol Dep*. 2021;21(3):32–47.
- Ato M, López-García JJ, Benavente A. A classification system for research designs in psychology. *Ann Psychol*. 2013;29(3):1038–59, <https://doi.org/10.6018/analesps.29.3.178511>.
- Montero I, León OG. A guide for naming research studies in Psychology. *Int J Clin Health Psychol*. 2007;7(3):847–62.
- Gamonales JM, Durán-Vaca M, Gámez-Calvo L, Hernández-Beltrán V, Muñoz-Jiménez J, León K. Fútbol para personas con amputaciones: revisión sistemática exploratoria. *Retos*. 2021(42):145–53, <https://doi.org/10.47197/retos.v42i0.86380>.
- Gamonales JM, Martín-Casañas E, Hernández-Beltrán V, Gámez-Calvo L, León K, Muñoz-Jiménez J. Walking football for older adults: systematic review. *E-balonmano Com*. 2021;17(3):195–210.
- Hernández-Beltrán V, Muñoz-Jiménez J, Gámez-Calvo L, Castelli Correia de Campos LF, Gamonales JM. Influence of injuries and functional classification on the sport performance in wheelchair basketball players. *Systematic review*. *Retos*. 2022(45):1154–64, <https://doi.org/10.47197/retos.v45i0.94090>.
- Thomas JR, Nelson JK, Silverman SJ. *Research Methods in Physical Activity*. Champaign, IL: Human Kinetics; 2015.
- Law M, Stewart D, Pollock N, Letts L, Bosch J, Westmoreland M. *Guidelines for critical review of qualitative studies*. *Quant Rev Form-Guidelines*. 1998: 1–11.
- Gamonales JM, Muñoz-Jiménez J, León K, Ibáñez SJ. Entrenamiento y confiabilidad entre observadores en el análisis del

- fútbol para ciegos. *Retos*. 2018(34):155–61, <https://doi.org/10.47197/retos.v0i34.55651>.
36. Sarmento H, Clemente FM, Araújo D, Davids K, McRobert A, Figueiredo A. What performance analysts need to know about research trends in association football (2012–2016): a systematic review. *Sports Med*. 2018;48:799–836, <https://doi.org/10.1007/s40279-017-0836-6>.
  37. Randolph JJ. Free-Marginal Multirater Kappa (multirater Kfree): an alternative to Fleiss' fixed-marginal Multirater Kappa. In: *Joensuu Learning and Instruction Symposium 2005, Finland: University of the Joensuu; 2005*.
  38. Polit D., Hungler B. (2000). *Investigación Científica En Ciencias de La Salud* (6a ed.). McGraw-Hill.
  39. Sainz de Baranda P, Adán L, García-Angulo A, Gómez-López M, Nikolic B, Ortega-Toro E. Differences in the offensive and defensive actions of the goalkeepers at Women's FIFA World Cup 2011. *Front Psychol*. 2019;10(223):1–10, <https://doi.org/10.3389/fpsyg.2019.00223>.
  40. Gavião LO, Gavião EV, Sant'Anna AP, Lima GB, Garcia PA. Performance analysis of professional soccer goalkeepers by composition of probabilistic preferences. *Rev Bras Ciên Esp*. 2021;43(e011420), <https://doi.org/10.1590/rbce.43.e011420>. 2021.
  41. Lames M. Chance involvement in goal scoring in football – an empirical approach. *Ger J Exer Sport Res*. 2018;48(2):278–86, <https://doi.org/10.1007/s12662-018-0518-z>.
  42. Sánchez-López R, Echeazarra I, Castellano J. Assessment of a Coding Tool to Analyse Goals in football (CODITAG). *Apunt Med l'esport*. 2023;1(151):58–69, [https://doi.org/10.5672/apunts.2014-0983.es.\(2023/1\).151.06](https://doi.org/10.5672/apunts.2014-0983.es.(2023/1).151.06).
  43. Jara D, Ortega E, MÁ Gómez, Sainz de Baranda P. Effect of pitch size on technical-tactical actions of the goalkeeper in small-sided games. *J Hum Kinet*. 2018;62(1):157–66, <https://doi.org/10.1515/hukin-2017-0167>.
  44. Kolbinger O, Stöckl M. Misbehavior during penalty kicks and goalkeepers holding the ball too long as trivial offenses in football. *Front Psychol*. 2019;10(844):1–7, <https://doi.org/10.3389/fpsyg.2019.00844>.
  45. Padulo J, Haddad M, Ardigo LP, Chamari K, Pizzolato F. High frequency performance analysis of professional soccer goalkeepers: a pilot study. *J Sports Med Phys Fit*. 2015;55(6):557–62.
  46. Seaton M, Campos J. Distribution competence of a football clubs goalkeepers. *Int J Perf Anal Sport*. 2011;11(2):314–24, <https://doi.org/10.1080/24748668.2011.11868551>.
  47. Vicente-Vila P, Lago-Peñas C. The goalkeeper influence on ball possession effectiveness in futsal. *J Hum Kinet*. 2016;51(1):217–24, <https://doi.org/10.1515/hukin-2015-0185>.
  48. López-Gajardo MA, González-Ponce I, Pulido JJ, García-Calvo T, Leo FM. Analysis of the technical-tactical actions by goalkeeper on football in competition. *Rev Int Med Cien Act Fís Dep*. 2010;20(80):577–94, <https://doi.org/10.15366/rimcafd2020.80.008>.
  49. Maher CG, Sherrington C, Herbert RD, Moseley AM, Elkins M. Reliability of the PEDro scale for rating quality of randomized controlled trials. *Phys Therapy*. 2003;83(8):713–21, <https://doi.org/10.1093/ptj/83.8.713>.
  50. Slim K, Nini E, Forestier D, Kwiatkowski F, Panis Y, Chipponi J. Methodological index for non-randomized studies (MINORS): development and validation of a new instrument. *ANZ J Surg*. 2003;73(9):712–6, <https://doi.org/10.1046/j.1445-2197.2003.02748.x>. 2003.
  51. Slade SC, Dionne CE, Underwood M, Buchbinder R. Consensus on exercise reporting template (CERT): explanation and elaboration statement. *BJSM*. 2016;50(23):1428–37, <https://doi.org/10.1136/bjsports-2016-096651>.