DESIGN, VALIDATION, AND RELIABILITY OF AN OBSERVATIONAL NOTATIONAL INSTRUMENT FOR THE FOOTBALL GOALKEEPER'S DEFENSIVE AND OFFENSIVE TECHNICAL-TACTICAL ACTIONS

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Abstract:

The aim of this study was to design and validate an observational instrument used to analyse the in-game behaviour of the football goalkeeper (GK) in defence and attack. The validation and reliability testing processes were carried out by twelve experts through five steps. Contents validity was calculated using Aiken's V and the kappa index was used to analyse reliability. The observational tool was divided into three different content blocks: GK's offensive actions, GK's defensive actions, and opponent's actions taken before a GK's defensive action. Only three out of the total of 24 items achieved low values that, after modifications, recorded optimal values (values higher than .90) in accordance with the Aiken's V. Following step one, new proposals were evaluated after a pilot test. The reliability test scored optimal values (values higher than .85). An observational sheet was developed to manage the quantitative and qualitative assessments of experts, and the proposed tool was accepted as valid and reliable.

Key words: *observational methodology, notational analysis, performance indicators, soccer*

Introduction

Performance analysis is becoming an essential tool in team and individual sports (Gómez, Lorenzo, Sampaio, Ibañez, & Ortega, 2008), and has gained special relevance over the last three decades (Mackenzie & Cushion, 2013). The possibilities it can offer to coaches and athletes are critical in the process of performance optimisation (Di Salvo, Benito, Calderon, Di Salvo & Pigozzi, 2008). The information athletes receive about their performance optimisation, from an objective perspective, will have an impact on the process of their learning and, as a consequence, on their performance (Hughes, Cooper, & Nevil, 2002; Hughes & Franks, 2004). Accordingly, notational analysis represents a research method for investigating different players' tactical, technical and other performance aspects of their in-game behaviour. Specifically, in team sports, these techniques aim to describe the participants' behaviour during real competitive scenarios (Vilar, Araujo, Davids, & Button, 2012).

The importance of notational analysis resides in the systematic observational coding of team's and player's behaviours (Ibañez, García, Feu, Parejo, & Cañadas, 2009; O'Donoghue, Holmes, & Robinson, 2017). Keeping in mind the concept of objectivity, notational analysis has to be based on scientific methodology and reliable codes that provide coaches with real and objective information on which they develop and design training sessions taking technical and tactical requirements into account.

In football, Sarmento et al. (2014) carried out a systematic review based on observational methodology, describing the technical, tactical and physiological variables which affected performance and had been the subject of study by the scientific community. Accordingly, a great number of observational instruments has been developed by researchers in order to give support to coaches and to cover some specific issues such as performance in set plays, match activity profiles, or collective group behaviour within this sport (Sarmento, et al., 2018). When focusing on publications about goalkeepers, the number of papers decreases, especially those based on competition analysis (García-Angulo & Ortega, 2015). Just a few studies have been performed with football goalkeepers and with the analysis of their competition performance as a focal point. Sainz de Baranda, Palao, and Ortega

(2008) carried out a descriptive analysis of goalkeeper's defensive technical actions. Liu, Gómez, and Lago-Peñas (2015) described the performance of elite goalkeepers focusing on their technique under situational variables. Similar studies have been developed with the same characteristics, using observational methodology (Szwarc, Lipinska, & Chamera, 2010). Activity profiles of professional (Di Salvo, et al., 2008) as well as non-professional goalkeepers (Condello, Lupo, Cipriani, & Tessitore, 2011) have also been described. Furthermore, there are a few studies which do not focus on the goalkeeper exclusively but offer information to coaches, such as the characteristics and patterns of shots on target and goals scored, thus allowing them to design training sessions with specific contents and to implement methodical training programmes specifically recommended for the goalkeeper's training (Park, Choi, Bang, & Park, 2016).

All the mentioned studies, focused on the goalkeeper in football, used observational methodology, although none of them defined the design and validity process applied to the observational tool used. Observational methodology based on data collection needs a valid and reliable information gathering tool in order to provide rigorous data that could be analysed without raising any methodological issues (Creswell, 2005; Sarmento, Anguera, Campaniço, & Leitão, 2010). Due to the lack of reports on metric characteristics of the tools developed in previous studies dealing with goalkeeper's performance and the need for a valid and reliable observational tool, the purpose of this paper was to design and validate an *ad-hoc* observational tool for the defensive and offensive technical-tactical actions of the football goalkeeper.

Methods

The design and validation process of the instrument was carried out in five steps. In step one and step two a preliminary list of variables was created. In the following two steps the contents validity was calculated by means of Aiken's V method. In step five inter- and intra-observer reliability of the instrument was tested using Cohen's Kappa coefficient (Cohen, 1925).

The ***first step*** was to detect the aspects related to the defensive and offensive technical and tactical actions of the goalkeeper. A review of the specific literature was made, which enabled the development of a draft with the variables and their definitions. Three groups of variables were defined: variables related to the attack created by the opposing team, variables related to the defensive actions by the goalkeeper, and variables related to his/her offensive actions.

In the ***second step***, a pilot observation was carried out with the aim of either refining the draft/definitions of the already listed variables or including new variables. Two matches were observed using the previously designed draft. Thereupon the list of variables was updated.

The ***third step*** was to calculate the contents validity of the instrument using expert criteria (N= 12). The experts fulfilled at least three of the five inclusion criteria proposed. Those criteria were: to have more than ten years of experience in professional football; to be in possession of the GK Coach UEFA Pro License; to be a specialist in performance analysis of the goalkeeper; to possess research knowledge in football performance; and to have a doctorate related to performance analysis in sports. The experts were asked about the variable definition, its pertinence to the study case, and a section was provided to comment on the inclusion of new variables (Table 1). The quantitative evaluation was done on a 10-point Likert-type scale, where one was the lowest score and ten the highest.

After the feedback provided by the experts, within the ***fourth step***, the list of variables was updated by including new variables requested by the experts. Once again, the experts filled in the questionnaire to test the internal validity of the instrument. For this, Aiken's V (Aiken, 1980; Penfield & Giacobbi, 2004) was used to test the experts' responses.

Table 1. Sample questionnaire sent to the experts

Deflection
(a) Definition: The ricocheting of the ball after coming into contact with the goalkeeper.
Poorly defined 0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10 Very well defined
Proposed definition, in case the previous one was not clear:
(b) Pertinence: Does it seem pertinent to include deflection as a technical defensive action of the goalkeeper category?
Not pertinent 0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10 Very pertinent
(c) Inclusion: What other category would you add to the observation instrument for the technical defensive action of the goalkeeper?

In the ***fifth step***, the instrument's reliability was tested. Two external observers were trained in the use of the observational instrument during five sessions. This training was split into three stages. During session one, the variables and categories were explained to the observers with the aim to familiarize them with the instrument. In the following two sessions, training was carried out in categories and codification detection. In the last two sessions, the observers were trained to observe real game situations randomly selected from the Champions League 15/16. Both observers collected data on the occurrence of forty-one defensive actions and forty-eight offensive actions performed by goalkeepers in each observation. The inter-observer reliability was calculated as the Cohen's Kappa coefficient using the software Lince v12.30 (Gabin, Camerino, Anguera, & Castañer, 2012). The intra-observer reliability was calculated after a re-observation of the first analysis of a full football match.

Results

The results show that, after the first two steps of the design of this instrument, the variables totalled: nine offensive, eight defensive and seven related to the attack created by the opposing team:

Variables related to the offensive actions performed by the goalkeeper

- *Obtaining the ball*: receiving the ball and getting it under control. A ball from a teammate; a ball from the opponent; other.
- *Control of the ball before performing the action*: did the goalkeeper contact the ball two or more times before the ball was played? Yes; no; not applicable.
- *Goalkeeper action*: technical action performed. Goal kick (a free kick taken by the defending side from within their goal area after the attackers send the ball over the end line outside the goal); indirect kick (a free kick from which a goal cannot be scored directly, like a restart after an offside call); direct kick (a free kick that can be scored without first being touched by another player); hand pass (bowling, sidearm low or bouncing, aerial overhand, others); kick (instep/laces, inside, side volley, frontal punt, dropkick); other.
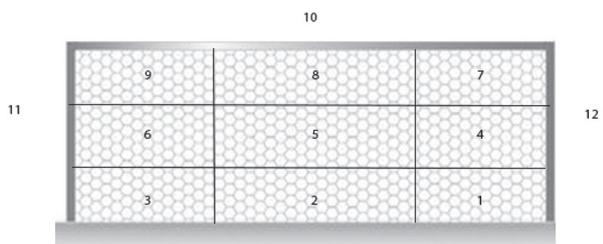

Figure 1. Zones of the goal.

- *Physical action*: any movement of the goalkeeper before taking the offensive action (yes; no)
- *Length* (Sainz de Baranda, Llopis, & Ortega, 2005): distance of a pass or kick reached by the offensive action (short – 1; medium – 2 or 3; long – 4) (Figure 2).
- *Orientation*: zone where a pass or kick ends up. Three zones: right side (1), central (2), left side (3) (Figure 3).
- *Precision*: effectiveness of a pass or kick. Three types: direct (when the ball is controlled immediately by the next team-mate who touches it); indirect (when the ball is controlled after being touched by another player first); No success (ball possession converted).
- *Scoring opportunity*: action resulting from the attack created by the opponent team (goal; penalty; corner kick; direct or indirect kick; shot on target).
- *Time*: minute and second when the action was performed.

Variables related to the defensive actions by the goalkeeper

- *Zone of goalkeeper intervention*: zone from where the goalkeeper performed his/her defensive action. It can be the goal area, penalty area, or outside of the penalty area.
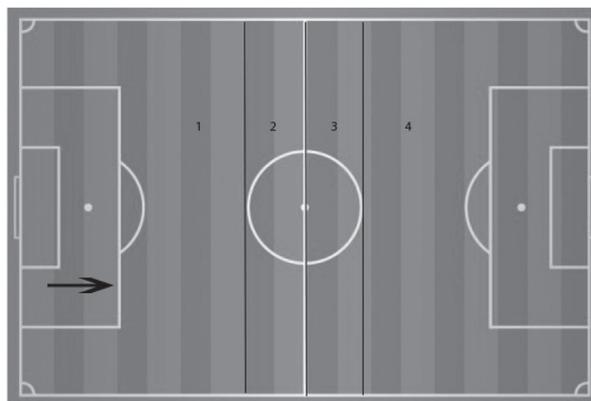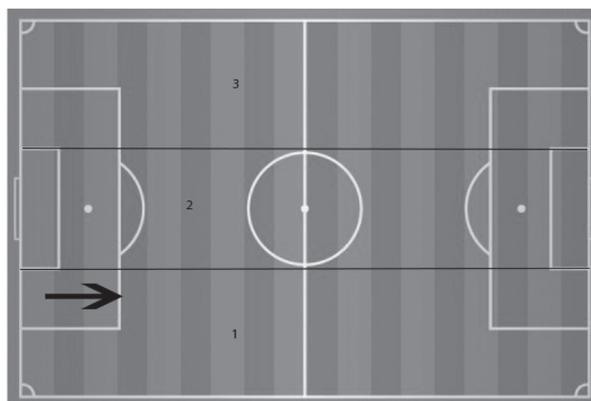

Figure 2. Length

Figure 3. Orientation

- *Zone of the goal*: when the opponent's attack ended with a shot. The zone where the ball ended up was recorded (Sainz de Baranda & Serrato, 2000). (Zones of the goal in Figure 1. When the ball ended up close to the goal and the goalkeeper carried out a defensive action within either goal area, penalty area, or outside of the penalty area).
- *Defensive technical actions*: save (catching the ball or blocking a shot, which prevents the opponent from scoring a goal); foot control (control over the ball with the feet and trying to pass it to a team-mate); parry (tipping); clear out (technique to remove the ball that cannot be caught by punching, heading or kicking the ball out with the foot); deflection (ricocheting the ball); open palm technique (used to get balls over the goalkeeper's head by guiding the ball over the crossbar); fly and/or dive (diving without a contact with the ball); 1-on-1 situation, screen or shield (protecting the ball from an attacker by keeping the body between the ball and the attacker); the ball cleared out by a defender other than the GK, or no action taken.
- *Physical actions*: physical actions performed by the goalkeeper during the defensive technical action. Movement: last corporal displacement performed (forward, right, left, diagonally forward to the right, diagonally forward to the left, diagonally backward to the right, diagonally backward to the left, and backward). Note: only the last movement performed before the technical action was recorded; dive: shuffling sideways or frontal in the direction the ball is going and landing on the ground without raising the feet from the ground (yes or no); fly: shuffling sideways or frontal in the direction of the ball raising the feet from the ground (yes or no); drop: bending the body to the ground (yes or no); and jump (yes or no).
- *Intensity of an action*: it defines the intensity of the action performed by the goalkeeper. Sub-maximum (the goalkeeper's intervention is of low difficulty and exertion, or the situation is not presenting immediate scoring danger); maximum (immediate scoring danger in the situation: speed of the ball, number of players involved in an attacking action, or location cause the goalkeeper to make a high-effort intervention).
- *Securing the ball*: how the ball was handled by the goalkeeper. Level one (the ball secured at the first attempt); level two (the ball secured but not at the first attempt); level three (the ball moved from danger); level four (the ball not secured and the second scoring opportunity possible); level five (touch on the ball but a goal scored); level six (no touch and a goal scored); level seven (off target); level eight (the ball securing attempt by a defender who maintains control over the ball); level nine (the ball moved from danger by a defender).
- *Goal*: scored by the opponent team (conceded or not).
- *Time*: the minute and second when the action was performed.

Variables related to the attack created by the opposing team

- *Type of attack*: type of the attack performed by the opposing team resulting in a defensive action of the goalkeeper. Positional attack (attack against organized defenders who have recovered); counter-attack (attacking quickly after regained possession by making four or fewer passes and not allowing defenders to recover and organize); set piece (a direct free kick, an indirect free kick, a corner, a penalty, a throw-in); a team-mate's pass back to the goalkeeper; the ball from the opposing goalkeeper; others; no pass or cross made (when the defender deflects and the attacker recovers the ball after a mistake from the opponent).
- *Location where the last pass of attack was made*. Zone of the field where the last pass of the opposing team was performed. Seventeen zones were differentiated on the field (Figure 4).
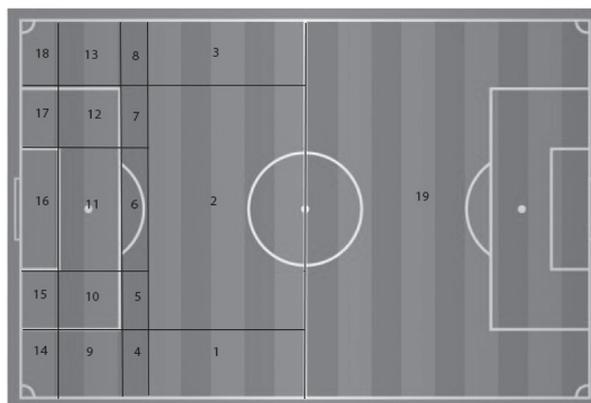

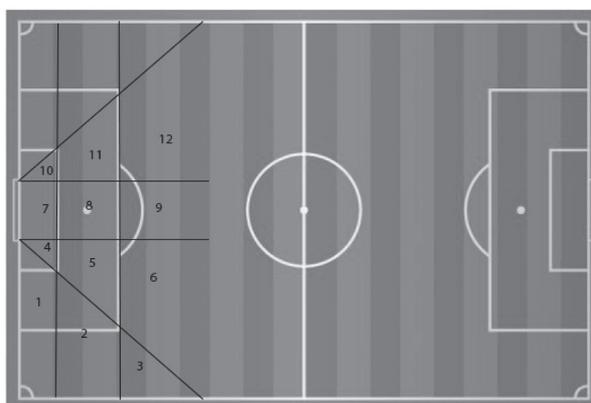*Figure 4. Location where the last pass of attack was made*

Figure 5. Field zone from where shots were taken

Table 2. Evaluation by experts on the variables related to the offensive actions done by the goalkeeper and the attack created by the opposing team

Variables	V Aiken	
	Definition	Pertinence
Offensive action by the goalkeeper		
Obtaining the ball		
A ball from a teammate	.97	.98
A ball from an opponent	.97	.98
Other	.97	.98
Control of the ball before performing the action	.98	.94
Goalkeeper action		
Goal kick	.94	1
Indirect kick	.94	.98
Direct kick	.84	.98
Hand pass	.93	1
Kick	.91	1
Physical action before the offensive action of the goalkeeper		
Movement	.94	.96
*Length**	.98	.94
Orientation	.97	.92
Precision		
Direct	.92	.99
Indirect	.92	.99
No success	.86	.99
Time	1	.97
*Scoring opportunity**	.97	.92
Attack created by the opposing team		
Type of attack		
Positional attack	.88	.94
Counter-attack	.88	1
Set piece	.94	1
Others	.87	1
No pass or cross made	.94	1
Location where the last pass of attack was made	.94	.98
Body part with which the last pass of attack was taken	.94	.97
Field zone from where shots were taken	.94	.97
The shooter	.97	.96
Body part with which the shot was taken	.98	1
*Type of a shot**	.97	.99

Note: *Variables evaluated in the third step

Table 3. Evaluation by experts on the variables related to the defence done by the goalkeeper

Variables	V Aiken	
	Definition	Pertinence
Physical action		
Jump	1	1
Dive	1	1
Fly*	.92	.99
Drop	.94	.98
Movement*	.98	.99
Defensive technical action		
No action taken	.98	1
Save	.88	1
Parry	.97	1
Clear out	.94	1
Deflection	1	1
Open palm technique	.89	1
Fly and/or dive	.89	.99
1-on-1	.91	.99
Screen or shield	.99	.99
Foot control	.98	.99
Clear out by a defensive player	.84	.9
Intensity of the action		
Submaximum*	.89	.91
Maximum*	.9	.91
Security of the ball		
Level 1	.99	.99
Level 2	.96	.99
Level 3	.96	.99
Level 4	.98	.99
Level 5	.97	.9
Level 6	.96	.97
Level 7	.99	.99
Level 8	.96	.99
Level 9	.98	.99
Zone of the goalkeeper intervention	1	1
Zone of the goal		
Zones from 1 to 12	1	1
Goal area, penalty area or outside of penalty area	1	1
Goal conceded	1	1
Time	1	1

Note: *Variables evaluated in the third step

- *Body part with which the last pass of attack was made*: the foot, the head, the hand, other (the chest, the abdomen, knee, etc.) or no pass or cross made.

- *Field zone from where shots were made* (Sainz de Baranda, Ortega, Llopis, Novo, & Rodríguez, 2005): zone of the field where the shot was performed by the opponent or a team-

Variables	Kappa Cohen	
	Intra-observer	Inter-observer
Obtaining the ball	1	1
Goalkeeper action	1	1
PA – Movement	1	1
Length	.95	.90
Orientation	1	1
Precision	1	.90
Scoring opportunity	1	1
Type of attack	.98	1
Location where the last pass of attack was made	.96	.88
Body part with which the last pass of attack was taken	1	1
Field zone from where shots were taken	.95	.86
The shotter	1	1
Body part with which the shot was taken	1	.86
PA – Jump	1	1
PA – Dive	1	1
PA – Fly	.96	1
PA – Drop	1	1
PA – Movement	1	1
Defensive technical action	1	1
Intensity of action	.91	.85
Security of ball	.96	1
Zone of goalkeeper intervention	1	1
Zone of the goal	.96	.86
Goal conceded	1	1
Time	1	1

Note: PA = Physical activity

mate. Zones can be differentiated in relation to a shooting angle and distance from the goal (Figure 5).

- *The shooter*: the player who performed the shot. Opponent; team-mate.
- *Body part with which the shot was made*: the right foot; left foot; the head; other (the chest, the abdomen, knee, hand of God, etc.); or no shot taken.
- *Type of a shot*: direct (without change of the ball trajectory); with a change of the ball trajectory made by the opposing team's player; with a change of the ball trajectory made by the own team's player.

The contents validity was calculated for all the variables and categories in the third and fourth step, once the suggestions noted by the experts had been incorporated (Tables 2 and 3). The V Aiken values were higher than .05 for the definition and higher than .80 for the pertinence (Aiken, 1985).

The fifth step showed values for the Cohen's Kappa index of the intra-observer reliability, presenting values higher than .90 and values higher than .85 for the inter-observer reliability (Table 4) according to the Altman's criteria (1991).

Discussion and conclusions

The present paper described all the stages that were necessary to design, validate and test the reliability of an observational instrument that analyses the technical-tactical actions of the goalkeeper in football, both in defence and attack. Since the information obtained by coaches and researchers is critical to define and develop the variables, as well as to define and accept the most appropriate consideration within the topic of the study (Villarejo, Ortega, Gómez, & Palao, 2014), the process must be represented in order to develop observational research, ensuring appropriate recording of each action (Moreno & Gomez, 2017).

As has been shown in previous studies, notational analysis is based on a systematic methodology in which the observational instruments require high validity and reliability standards, for both the design process and their usefulness for gathering data from competitions (O'Donoghue, et al., 2017). In this case, the development of the observational instrument will allow researchers, coaches and players to perform a complete and exhaustive evaluation of the goalkeeper's performance, ensuring the quality of the research and the key results from any competition (Moreno & Gómez, 2017; Villarejo, et al., 2014). The current research has some limitations that should be addressed such as the limited number of participants as experts in this field. Further research is needed to provide information about the key performance indicators and normative profiles (Palao & Manzanares, 2013) to guide the training process for optimal teaching/learning development (Lago-Ballesteros & Lago-Peñas, 2010).

Some studies with an observational focus have been carried out to describe both the defensive and offensive tactical and technical behaviours of the goalkeeper (Liu, et al., 2015; Sainz de Baranda, et al., 2008; Seaton & Campos, 2011; Szwarc, et al., 2010). All prior studies on the technical and tactical analysis of the goalkeeper had the same methodological flaw in common: none used a previously validated and reliable instrument of observation. It would be necessary to use the same methodological approach in future studies since there are a number of variables that cannot be compared with each other due to methodological problems in the use of different observational instruments created for each study. Thus, in order to analyse the defensive technical-tactical actions, the researchers understood

that if a tactical analysis was aimed to be resulting from the analysis carried out by means of this observational instrument, it was necessary to analyse what has occurred before the defensive technical-tactical action performed by the goalkeeper. This can help us to understand why some behaviours are performed instead others, or when these behaviours are present in the match. In this way, continuing with the idea of why or when different behaviours appear, the link among technical-tactical actions, both defensive and offensive, will provide a better understanding, giving to this manuscript the relevance that this topic deserves.

The validity and reliability process was carried out in different stages, following the steps previously done by other researchers (Moreno & Gomez, 2017; Palao, et al., 2015; Sarmento, et al., 2010; Villarejo, et al., 2014). After a review of available literature regarding the goalkeeper and its analysis, a pilot study was defined, in order to create and define the first list of variables that could take place during competition (Anguera & Hernandez-Mendo, 2015) that would subsequently be revised by the experts, both qualitatively and quantitatively. All values obtained scores above the minimum proposed in the literature (Penfield and Giacobbi, 2004) where no more modification had to be made by the experts. The values regarding the level of intra- and inter- reliability reached in this study showed that the instrument is reliable, overcoming the minimum values proposed by Altman (1991).

Finally, for the purpose of ensuring the quality of the data obtained, it is essential to prove the validity of the instrument, as well as the reliability of data gathering, both inter- and intra-observer. Once all the results had been analysed, it could be concluded that the designed instrument was valid and reliable and can be used in the analysis of defensive and offensive technical-tactical actions of the goalkeeper due to the fulfilment of the minimum validity and reliability values required (Moreno & Gomez, 2017; Palao et al., 2015; Villarejo et al., 2014). Any notational analysis requires the data collection process to be valid and reliable, which will allow errors in identifying performance indicators to be minimised (O'Donoghue, et al., 2017). In this manner, this study can provide researchers and coaches with a valid and reliable instrument aiming to analyse the behaviour of the goalkeeper.

References

Aiken, L. (1985). Three coefficients for analyzing the reliability and validity of ratings. *Educational and Psychological Measurement*, *45*(1), 131-142. https://doi.org/10.1177/0013164485451012

Aiken, L.R. (1980). Content validity and reliability of single items or questionnaires. *Educational and Psychological Measurement, 40*(4), 955-959. https://doi.org/10.1177/001316448004000419

Altman, D. G. (1991). Some common problems in medical research. In D.G. Altman (Ed.), *Practical statistics for medical research* (pp. 403-409). London: Chapman & Hall.

Anguera, M.T., & Hernandez-Mendo, A. (2015). Data analysis techniques in observational studies in sports sciences. *Cuadernos de Psicología del Deporte, 15*, 13-29. http://doi.org/10.4321/S1578-84232015000100002

Creswell, J.W. (2005). *Research design: Qualitative, quantitative, and mixed method approaches* (2nd ed.). London: SAGE.

Cohen, J. (1925). Weighted Kappa: Nominal scale agreement with provision for scaled disagreement or partial credit. *Psychological Bulletin*, *70*(4).

Condello, G., Lupo, C., Cipriani, A., & Tessitore, A. (2011). Activity profile of a no-professional goalkeeper during official matches. *Annals of Research in Sport and Physical* Activity, *2*, 94.

Di Salvo, V., Benito, P.J., Calderón, F.J., Di Salvo, M., & Pigozzi, F. (2008). Activity profile of elite goalkeepers during football match-play. *Journal of Sports Medicine and Physical Fitness, 48*(4), 443-446.

Gabin, B., Camerino, O., Anguera, M.T., & Castañer, M. (2012). Lince: Multiplatform sport analysis software. *Procedia – Social and Behavioral Sciences, 46*, 4692-4694. doi:10.1016/j.sbspro.2012.06.320

García-Angulo, A., & Ortega, E. (2015). Análisis bibliométrico de la producción científica sobre el portero en fútbol. [Bibliometric analysis of scientific production over the goalkeeper in soccer.]. *Revista Iberoamericana de Psicología del Ejercicio y el Deporte, 10*(2), 205–214.

Gómez, M.A., Lorenzo, A., Sampaio, J., Ibáñez, S., & Ortega, E. (2008). Game-related statistics that discriminated winning and losing teams from the Spanish men's professional basketball teams. *Collegium Antropologicum, 32*(2), 451-456.

Hughes, M., Cooper, S.M., & Nevill, A. (2002). Analysis procedures for non-parametric data from performance analysis. *International Journal of Performance Analysis in Sport, 2*(1), 6-20.

Hughes, M., & Franks, I.M. (2004). *Notational analysis of sport: Systems for better coaching and performance in sport.* Oxon: Routledge.

Ibáñez, S.J., García, J., Feu, S., Parejo, I., & Cañadas, M. (2009). La eficacia del lanzamiento a canasta en la NBA: Análisis multifactorial. [Shot efficacy in the NBA: A multifactorial análisis.]. *Cultura, Ciencia y Deporte*, *4*(10), 39-47. https://doi.org/10.12800/ccd 4.10

Lago Ballesteros, J., & Peñas, C. (2010). Performance in team sports: Identifying the keys to success in soccer. *Journal of Human Kinetics, 25*, 85-97.

Liu, H., Gómez, M.A., & Lago-Peñas, C. (2015). Match performance profiles of goalkeepers of elite football teams. *International Journal of Sports Science and Coaching, 10*(4), 669-682. https://doi.org/10.1260/1747-9541.10.4.669

Mackenzie, R., & Cushion, C. (2013). Performance analysis in football: A critical review and implications for future research. *Journal of Sports Sciences, 31*(6), 639-676. https://doi.org/10.1080/02640414.2012.746720

Moreno, E., & Gómez, M.Á. (2017). Validación herramienta observacional para el análisis de rachas de lanzamiento en baloncesto. [Validation of an observational instrument for shooting streaks in basketball.]. *Revista de Psicología del Deporte, 26*(3), 87-93.

O'Donoghue, P., Holmes, L., & Robinson, G. (2017). *Doing a research project in sport performance analysis*. Oxon: Routledge.

Palao, J.M., Manzanares, P., & Ortega, E. (2015). Design, validation, and reliability of an observation instrument for technical and tactical actions in indoor volleyball. *European Journal of Human Movement*, *34*(1), 75-95. https://doi.org/10.1590/S1980-65742015000200004

Palao, J.M., & Morante, J.C. (2013). Chapter 17. Technical effectiveness (pp. 213-224). In T. McGarry, P. O'Donoghue & J. Sampaio (Eds.), *Routledge handbook of sports performance analysis*. London: Routledge.

Park, Y., Choi, M., Bang, S., & Park, J. (2016). Analysis of shots on target and goals scored in soccer matches: Implications for coaching and training goalkeepers. *South African Journal for Research in Sport, Physical Education and Recreation, 38*(1), 123-137.

Penfield, R.D., & Giacobbi, P.R. (2004) Applying a score confidence interval to Aiken's item content-relevance index. *Measurement in Physical Education and Exercise Science, 8*(4), 213-225.

Sainz de Baranda, P., Llopis, L., & Ortega, E. (2005). *Metodología global para el entrenamiento del portero de fútbol*. [Global methodology for the goalkeeper training in football.]. Sevilla: Wanceulen.

Sainz de Baranda, P., Ortega, E., Llopis, L., Novo, J.F., & Rodríguez, D. (2005). Análisis de las acciones defensivas del portero en el fútbol 7. [Analysis of defensive actions of the goalkeeper in U12 football.]. *Apunts: Educación* Física y *Deportes*, *80*, 45-52.

Sainz de Baranda, P., Ortega, E., & Palao, J.M. (2008). Analysis of goalkeepers' defence in the World Cup in Korea and Japan in 2002. *European Journal of Sport Science, 8*(3), 127-134. https://doi.org/10.1080/17461390801919045

Sainz de Baranda, P., & Serrato, D. (2000). La utilidad de las Hojas de Observación en el Portero de Fútbol: Parte primera. [The utility of the observational sheets for the goalkeeper in football: Part one.]. *Cuadernos del Entrenador. Revista de la Federación Española de Fútbol, 85*, 34-51.

Sarmento, H., Anguera, M.T., Campaniço, J., & Leitão, J. (2010). Development and validation of a notational system to study the offensive process in football. *Medicina (Kaunas), 46*(6), 401-407.

Sarmento, H., Clemente, F.M., Araújo, D., Davids, K., McRobert, A., & Figueiredo, A. (2018). What performance analysts need to know about research trends in association football (2012–2016): A systematic review. *Sports Medicine, 48*(4), 799-836. doi:10.1007/s40279-017-0836-6

Sarmento, H., Marcelino, R., Anguera, M.T., Campaniço, J., Matos, N., & Leitão, J. C. (2014). Match analysis in football: A systematic review. *Journal of Sports Sciences, 32*(20), 1831-1843. https://doi.org/10.1080/02640414.2014.898852

Seaton, M., & Campos, J. (2011). Distribution competence of a football club's goalkeepers. *International Journal of Performance Analysis in Sport, 11*, 314-324. https://doi.org/10.1080/24748668.2011.11868551

Szwarc, A., Lipińska, P., & Chamera, M. (2010). The efficiency model of goalkeeper's actions in soccer. *Baltic Journal of Health and Physical Activity, 2*(2), 132-138. https://doi.org/10.2478/v10131-0013-x

Vilar, L., Araújo, D., Davids, K., & Button, C. (2012). The role of ecological dynamics in analysing performance in team sports. *Sports Medicine, 42*(1), 1-10. https://doi.org/10.2165/11596520-000000000-00000

Villarejo, D., Ortega, E., Gómez, M.Á., & Palao, J. M. (2014). Design, validation, and reliability of an observational instrument for ball possessions in rugby union. *International Journal of Performance Analysis in Sport, 14*, 957-969. https://doi.org/10.1080/24748668.2014.11868771

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