Article

Analysis of the Variables Influencing Success in Elite Handball with Polar Coordinates

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Abstract: In today's elite handball, coaching staff seek to know as much as possible about all the details of their sport to gain an advantage by adapting their model of play or by looking for the opponent's weak points. Therefore, the aim of this study was to analyse which variables can influence success in each phase of the match with polar coordinates. Observational methodology was used to analyse success or failure within the nature of handball by means of an ad hoc observation instrument designed and validated for this research. A total of 14 elite men's handball matches from the 2019–2020 season were analysed. The relationships between success and failure of all behaviours were performed with polar coordinates. The results show that one of the keys to achieving victory in matches is centred on a high level of success in the defensive phase that allows the team to recover the ball and to be able to go on the counterattack to obtain a clear option for a goal. This research allows us to see how we can achieve success in the different phases of the game and improve team performance with these indicators. These results suggest that it is necessary for teams to train at a high pace of play, linking the different phases of the game in order to recover the ball in the defensive phase and attack in the shortest possible time against an unstructured defence to achieve success in the match and the final victory.

Keywords: team sports; observational methodology; competition; performance indicators; key behaviour

1. Introduction

There is a lot of research that has shown that knowing what the players need to endure on a conditional level in handball is key to improving performance [1–3] and, in turn, preventing injuries [4].

In handball, these needs have also been described either through the video tracking [5], hand notational analysis [6,7] or more modern technologies such as inertial measurement unit technology (IMU's) [1].

However, in order to improve team performance, it is also essential to know which tactical actions are more effective or less effective depending on the model of play developed by the team in the different phases of the game. There is a large body of research that has analysed what happens during handball matches. Which offensive systems are used [8], the differences in counterattack between seniors and young players same time, the effectiveness of the attack against certain defensive systems have been observed [9,10]. Research has also been carried out on the effectiveness of attack at critical moments in the game types of last action happen [11].

At the defensive level, the effectiveness of the goalkeeper has been investigated [12] assessing the interaction with teammates or the attacker/defender ratio [13], the relevance

of defensive actions in the functioning of the team has been analysed [14,15] or the effect of fouls within the defensive phase and analysed their effectiveness [16].

Other research has focused on looking at offensive and defensive coefficients in different phases of the game [15], determining performance indicators to predict a match win [17], analysing the game according to the state of the score [15,18,19], assessing the influence of symmetry/asymmetry on the number of players on the game [20,21], and finding indicators of success or failure in the different phases of the game [17]. Success or failure has always been understood as being linked in the offensive phases to scoring goals and not interrupting the rhythm of the game, and in the defensive phases, the opposite: not conceding a goal, recovering the ball and cutting the rhythm of the attacking play [8].

All this research has been based on observational methodology, a technique widely used and validated in the world of sport for this type of analysis [22]. This methodology is developed in the usual context of sport. It is an ecological technique [23] that does not change the usual behaviour of players and unites science and practical application [24]. The aim is to analyse perceptible behaviours in order to be able to record, in an organised way, what happens through an instrument containing the appropriate parameters created ad hoc [25]. The different tools created by these investigations have analysed criteria in defence, attack, and counterattack; the sequence, the score, and the numerical situation of the players; and the area where the action takes place, or, the final result of the action, be it offensive or defensive [8,9,17,23,25,26].

Within the observational methodology, a technique widely used in the field of sport is the analysis of polar coordinates [27]. This technique was created by Sackett [28] and subsequently improved with the "genuine technique" of Anguera [29]. Its great usefulness is that it allows a significant reduction in the volume of data and a vector representation of the relationships established between the focal and conditional categories [30]. This technique offers us the possibility of estimating the type of relationships established between the focal behaviour or criterion and the rest of those that make up the taxonomic system [31]. The coordinate axis is divided into four quadrants. Depending on the quadrant where the categories are located, there will be a relationship with respect to the focal behaviour of activation or inhibition to the extent that this relationship exists [31].

This technique has been used in handball for the following applications: observing the effectiveness in the attacking phase [8] and in close matches [23], learning how different defensive systems are attacked [9], identifying differences in counterattack between seniors and young players [26], and observing the numerical ratio of players in attack and its tactical modification [32].

The aim of this study is to identify which variables influence success or failure in the different phases of the game in an elite handball team with polar coordinates. For this reason, the multiple variables that intervene in the game and in each phase have been evaluated, considering the game model of the team analysed and how the other teams play. Knowing how we can achieve success in the different phases of the game and which variables determine performance should help the different technical staff to increase the work on these variables in training to obtain certain advantages over the rival team in order to win the game and improve performance.

2. Materials and Methods

2.1. Design

An observational methodology was used because it is adapted to the reality of sport, capturing the nature of sport with an ad hoc instrument and being able to obtain a systematic analysis [22,23]. It is a methodology widely used in sport analysis [20,24,27].

The design used was defined as nomothetic, punctual, and multidimensional, and placed in the IV quadrant of observational designs [33]. It is nomothetic, due to the analysis of the plurality of the observed teams facing each other; punctual, as we analyse different matches of the same team together in a season; and multidimensional, as there are different dimensions that correspond to the different criteria of the observational instrument. All

the phases that make up a handball match were analysed: attack, counterattack, transition defence, and defence.

2.2. Sample

We analysed 14 FC Barcelona handball matches during the 2019–2020 season between the Spanish League and the European Champions League played at home (Table 1). We analysed FC Barcelona and the behaviour of their opponents when they played against them. In the 14 matches, the play of a total of 23 FC Barcelona players was analysed. These players played the entire season without an injury period in any of them that prevented them from being fit to play in 80% of the matches. It should be noted that the team played 39 games during the season, winning 38 and losing only 1, being a clear winning team. The videos used were publicly accessible, so according to the Belmont Report (https://student.societyforscience.org/human-participants, accessed on 19 Novembre 2022), it is not necessary to obtain the informed consent of the players [24]. Home matches were chosen because they were easier to obtain and of better quality than away matches as they were obtained directly from the TV production team.

Table 1. FC Barcelona matches played, competition and goal difference.

Game	Competition	Goal Difference
Anaitasuna	Spanish League	+17
Huesca	Spanish League	+23
Granollers	Spanish League	+14
Sagunto	Spanish League	+21
Cangas	Spanish League	+21
Sinfin	Spanish League	+24
Valladolid	Spanish League	+15
Celje	European Champions League	+24
Elverum	European Champions League	+9
Paris	European Champions League	+4
Aalborg	European Champions League	+9
Flensburg	European Champions League	+4
Zagreb	European Champions League	+9
Szeged	European Champions League	+2

The Belmont Report describes basic ethical principles and guidelines regarding ethical issues in human research. In addition, this study does not require a review by a research ethics committee, nor does it require written informed consent for the following reasons: (a) it involves observation of individuals in public places (sports hall); (b) the individuals or groups observed have no reasonable expectation of privacy; (c) it does not involve staged researcher intervention or direct interaction with individuals.

2.3. Instruments

In order to carry out the research, an ad hoc observation instrument was constructed to analyse all variables that can occur in all phases of a handball match (Table 2). All categories fulfilled the requirement of completeness and mutual exclusivity [22,26].

The different criteria observed were:

Criterion Competition: Type of competition belongs to the observed match.
Criterion Observed Team: Team that in the observed moment realizes the phase.
Criterion Phases of the Game: Different game sequences that we can differentiate with the alternation of possession of the ball by a team.
Criterion Number of Players: Relation of number of attackers and number of defenders in the observed situation.
Criterion Score: Difference in goals between the two teams.
Criterion Sequences: Number of attempts within the same phase of possession or recovery of the ball resulting from an interruption in the game.

Criterion Defence: Team structure observed in the organized defence phase.
Criterion Attack: Team structure observed in the system attack phase.
Criterion Rival Defence: Structure of the rival team in the organized defence phase.
Criterion Rival Attack: Structure of the rival team in the system attack phase.
Criterion Passive Play: Tendency of the attacking team to retain possession of the ball without attacking or throwing at goal.
Criterion Player: Which player performs the observed action.
Criterion Zone: Delimitation of six zones of the playing field where the different actions of the game are developed.
Criterion Intermediate Results: Situation that represents an interruption in the game, the teams continue within the same phase and there is no alternation in possession of the ball.
Criterion Final Result: Different game actions that involve the change in possession of the ball.
Criterion Disciplinary Action: Sanction on unsportsmanlike conduct on any of the components of the team observed.
Criterion Rival Disciplinary Action: Sanction on unsportsmanlike conduct on any of the components of the rival team.

The different categories are described in Table 2.

2.4. Data Quality Control

This tool, TAHSUFAIL for the identification of success or failure, was validated by a group of 13 experts. All of them have a degree in sports science and a minimum of experience as handball coaches in first division teams in different countries. The instrument was validated through the analysis of the Aiken V coefficient [34] between the experts' ratings of the different categories determined 0.99 for belonging, 0.97 for clarity, and 0.98 for total.

Table 2. Observation instrument for the games: Tactical analysis handball success–failure (TAHSUFAIL).

Criteria	Categories	Description	Criteria	Categories	Description
Competition	ASO	Spanish League		D60R	Defence 6:0 Rival
	CHA	Champions League		D51R	Defence 5:1 Rival
Team	TA	Team A		D42R	Defence 4:2 Rival
	TB	Team B	Rival Defence	D33R	Defence 3:3 Rival
Phases game	AT	Attack		MDR	Mixed Defence Rival
	CA	Counterattack		MDDR	Mixed Double Defence Rival
	DF	Defence		IDR	Individual Defence Rival
	TD	Transition Defence		UDR	Unstructured Defence Rival
Number of players	EQ	Equals		ODR	Other Defence Rival
	INF 1	1 player less without Gk		ACWAR	Circulate Wing Rival
	INF 2	1 player less with Gk		AWDPR	Double Pivot Wing Rival
	INF 3	2 players less without Gk	Rival Attack	ABDPR	Double Pivot Back Rival
	SUP 1	1 more player (other no Gk)		A24R	Attack 2:4 with 2 Pivots Rival
	SUP 2	1 more player (other Gk)		A33RPI	Attack 3:3 with 2 Pivots
	SUP 3	2 more player (other no Gk)		A33R	Attack 3:3 Rival
	ONS	Other numerical situations		OAR	Other Attacks Rival

Table 2. *Cont.*

Criteria	Categories	Description	Criteria	Categories	Description
Score	W1	+1	Passive play	PP	Passive Notice
	W2	+2	Player	Number	Player's Number
	W3	+3	Zone	Z1	
	W4	+4		Z2	
	WPLUS4	>+4		Z3	
	DR	Draw		Z4	
	L1	−1		Z5	
	L2	−2		Z6	
	L3	−3	Intermediate Result	BI	Block but No Change Possession
	L4	−4		F	Foul No Change Possessions
	LPLUS4	>−4		TI	Throw but No Change Possession
Sequences	S1	Sequence 1		TO	Time Out
	S2	Sequence 2		INTO	Interception but No Change Possession
	S3	Sequence 3		7m	Penalty
	S4	Sequence 4	Final Result	GL	Goal
	S5	Sequence 5		TR	Throw and Change Possession
	S6	Sequence 6		ST	Goalkeeper Save the Ball
				TF	Foul and Change Possession
				INTIN	Interception of the Ball
				BO	Block and Change Possession
				PAS	Passive and Change Possession
Defence	D60	Defence 6:0	Disciplinary Action	2M	Player 2 min Out
	D51	Defence 5:1		YC	Yellow Card
	D42	Defence 4:2		RC	Red Card
	D33	Defence 3:3		BC	Blue Card
	MD	Mixed Defence	Rival Disciplinary Action	2MR	Player 2 min Out Rival
	MDD	Mixed Double Defence		YCR	Yellow Card Rival
	ID	Individual Defence		RCR	Red Card Rival
	UD	Unstructured Defence		BCR	Blue Card Rival
	OD	Other Defence			
Attack	ACWA	Circulate Wing			
	AWDP	Double Pivot Wing			
	ABDP	Double Pivot Back			
	A24	Attack 2:4 with 2 Pivots			
	A33PI	Attack 3:3 with 2 Pivots			
	A33	Attack 3:3			
	OA	Other Attacks			

The observation of the matches was carried out by four observers, graduates in sports science and physical trainers with 10 years of experience in handball. After a period of observer training with the TAHSUFAIL observation instrument and the use of the software, the reliability of the observers was analysed through intra-observer and inter-observer concordance tests. Table 3 shows the different statistics that were used for the validation of the intra-observer and inter-observer tool: Cohen's Kappa [35], Fleiss' Kappa [36] and Iota Coefficient [37]. All the results obtained demonstrated reliability of the observers.

Table 3. Intra- and inter-observer agreement.

Coefficient for Entire Session	Intra-Observer Agreement	Inter-Observer Agreement
Cohen's Kappa	0.98	0.97
Fleiss' Alpha	0.98	0.97
Iota Coefficient	0.98	0.97

2.5. Matches' Analysis

Once the tool was created and validated, all matches were analysed with the free software LINCE PLUS [38]. A previous version of this software has been used in various research projects in the field of handball with observational methodology [23]. All the observation criteria and instruments were entered into the software. At the end of the analysis of all observed matches, we obtained a total of 2581 sequences. For each match, a coded record of all data was exported in Excel format.

Once the match data had been obtained, the Hoisan programme was used [39] for coding and subsequent analysis with polar coordinates and the representation [40].

2.6. Generalisability Analysis

A generalisability analysis [41] was performed using the SAGT software, version 1.0 [42] (see Table 4). Following the habitual attack system of Miranda et al. [43], two measurement plans have been carried out to address: (A) the generalisability of the results obtained (number of plays that make up the sample) and (B) the validity of the observation instrument: (a) the generalisability coefficient (relative and absolute = 0.998) corresponding to the measurement plan [Categories]/[Plays] establishes that with the number of plays analysed a high reliability of generalisation accuracy is obtained; (b) with respect to the [Plays]/[Categories] measurement plan, the generalisability coefficient (relative and absolute = 0.000), supports—in the theoretical framework of the generalisability theory—the validity of the observation instrument designed [44].

Table 4. Results corresponding to the Generalisability design [Categories] [Plays].

Sources of Variation	Sum of Squares	Degree of Freedom	Mean Square	% Variance	Standard Error
[PLAYS]	12.838	1667	0.008	0	0
[CATEGORIES]	3842.188	68	56.503	27.616	0.006
[PLAYS][CATEGORIES]	10,048.711	113.356	0.089	72.384	0

2.7. Procedures: Polar Coordinate Analysis

In order to find the most significant variables in the different phases of the game, the polar coordinates technique was used to reduce the large volume of data obtained [27]. This technique is based on a sequential analysis of prospective and retrospective lags of the data obtained [28,29] and enables us to observe the relationships that exist between the behaviours that make up the taxonomic system we have created [27]. From this analysis, we obtained contrast statistics, Zsum ($Zsum = \Sigma z/\sqrt{n}$, where n is the number of delays) [45] with delay ranges from −5 to +5.

Once we had the results, we made a graphical representation of the relationships found between the focal and conditioned categories at the vector level [30]. The length of the vector is the distance between the origin of coordinates Zsum (0,0) and the intersection

point (Zsum value of the focal behaviour on the X-axis and Zsum value of the conditioned behaviour on the Y-axis). Relationships are considered significant ($p < 0.05$) when the lengths are greater than 1.96 [46]. This value is obtained with the square root of the sum of the square of the Zsum of X (prospective) and the square of the Zsum of Y (retrospective). In addition, the angle of the vector (φ = Arc sine of Y/Radius) determines the nature of the relationship [27].

The characteristics of each quadrant of the polar coordinates are [27] (Figure 1):
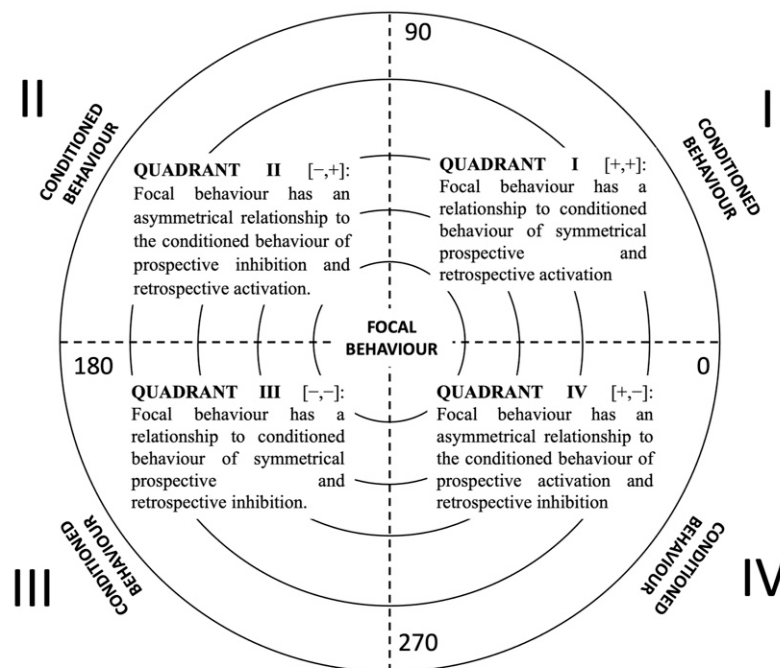

Figure 1. Characteristics of each quadrant of the polar coordinates.

The focal behaviours used were SUCCESS and FAILURE and were related to the other criteria.

All the categories observed through the observation tool should explain how we can achieve success or failure in the different phases of the game through this polar coordinate analysis. If we analyse only success, we considered that, at the defensive level, all criteria that entailed a disruption of the opposing team's attacking play or the recovery of the ball and possession were understood as success. On the offensive level, anything that was finishing an attack with a goal or achieving numerical superiority for the team was also considered a success. In terms of failure in the offensive phase, any interruption of play by the opposing team or loss of possession for various reasons was considered a failure. In the defensive phase, everything that led to conceding a goal or suffering a numerical inferiority in the number of players was also analysed as a failure.

3. Results

The analysis of the data with the polar coordinate's technique gave us a behavioural map of the focal behaviours, SUCCESS and FAILURE, with the other behaviours of the observation tool in the different quadrants (Table 5).

Quadrant I (Prospective and retrospective activation):

In Quadrant I, where the relationship between the behaviours is one of mutual prospective and retrospective activation, all the categories that relate to the focal behaviour mean that the more times they are performed during the match, the more they stimulate this success and vice versa; there is a double activation.

With the results obtained in the behaviour SUCCESS (Figure 2), this is related to the 6:0 defensive system (9.49) itself and, in turn, to the defensive phase (9.53). There is also

a relationship with the opposing team's attack when they attack with a circulation of the team's wing (2.18), attack with a double pivot by a wing (5.38) and attack with a double pivot by a back (2.68). There is also a relationship with the counterattack phase (5.86), Zone 1 finishing (2.58), sequence 1 (2.51), interception and recovery of the ball (2.20) and defensive blocking and change of possession (2.10).

Table 5. Significant relationships found with the focal behaviours SUCCESS and FAILURE.

| Criterion Behaviour	SUCCESS			FAILURE		
Q	**Paring Behaviour**	**Vector Module**	**T-Angle**	**Paring Behaviour**	**Vector Module**	**T-Angle**
I	Defence 60	9.49	4.97	Circulate Wing	2.84	77.53
	Circulate Wing Rival	2.18	31.25	Double Pivot Wing	6.01	3.22
	Double Pivot Wing Rival	5.38	2.71	Defence 51 Rival	2.24	33.81
	Double Pivot Back Rival	2.68	14.12	Other Defence Rival	3.39	49.56
	Defence	9.53	0.75	Defence 51	2.10	70.51
	Counterattack	5.86	13.27	Other Defence	3.88	66.62
	Zone 1	2.58	11.44	Unstructured Defence	7.70	20.18
	Sequence 1	2.51	21.23	Transition Defence	9.02	18.32
	Interception of the Ball	2.20	9.71	Zone 2	2.03	85.57
	Block and Change Possession	2.10	63.27	Throw but No Change Possession	1.98	62.61
				Sequence 2	2.27	55.12
II	Attack 33	11.26	179.05	Attack 33 Rival	5.08	177.89
	Defence 60 Rival	10.60	176.70	Defence	9.79	178.68
	Attack	13.24	179.57	Goalkeeper Save the Ball	2.18	166.99
	Zone 4	3.26	144.47			
	Sequence 3	2.25	156.04			
	Penalty	3.92	145.98			
III	Circulate Wing	3.18	253.38	Defence 60	9.82	183.29
	Double Pivot Wing	6.41	182.30	Circulate Wing Rival	2.40	207.88
	Other Defence Rival	3.52	238.07	Double Pivot Wing Rival	6.07	181.81
	Other Defence	4.07	247.71	Double Pivot Back Rival	2.20	185.79
	Unstructured Defence	7.53	203.26	Counterattack	5.42	195.70
	Transition Defence	8.67	200.57	Zone 1	2.24	196.18
	Zone 2	2.11	260.82	Zone 5	2.46	247.55
	Sequence 2	2.39	224.36			
	Throw No Change Possession	2.07	239.26			
IV	Attack 33 Rival	5.29	359.63	Attack 33	11.06	359.06
	Goalkeeper Save the Ball	2.52	334.93	Other Attacks	1.99	331.99
				Defence 60 Rival	10.23	356.09
				Attack	12.75	358.45
				Zone 4	3.54	326.95
				Penalty	3.97	330.89
				Interception of Ball	2.28	194.42
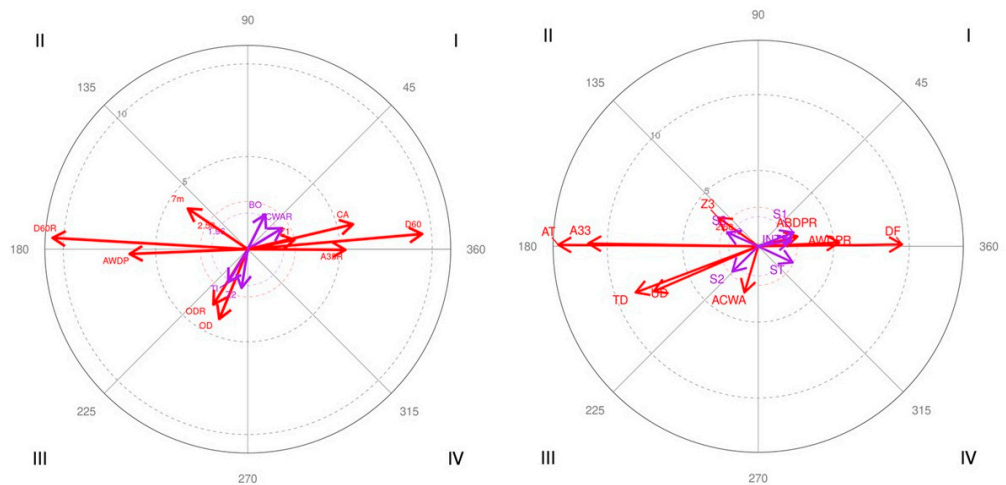
Figure 2. Vector maps for local behaviour SUCCESS. I: Quadrant I; II: Quadrant II, III: Quadrant III; IV: Quadrant IV.

When analysing the focal behaviour FAILURE (Figure 3) in Quadrant I, there is a relationship with the circulation of the wing (2.84) and the transformation of a wing to a pivot (6.0). At the defensive level, there are relationships with the 5:1 defensive system, of the observed team (2.10) and the opponent's (2.24), other defences of the observed team (3.88) and opponent's (3.39), and unstructured defence (7.70). There is also a relationship with transition defence (9.02), Zone 2 (2.03), the throw-in without change of possession (1.98), and sequence 2 (2.27).
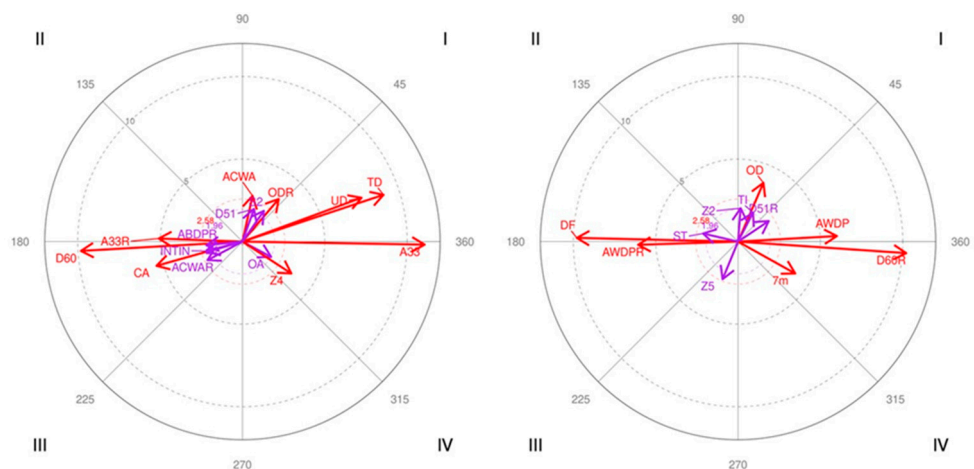
Figure 3. Vector maps for local behaviour FAILURE. I: Quadrant I; II: Quadrant II, III: Quadrant III; IV: Quadrant IV.

Quadrant II (Prospective inhibition and retrospective activation):

In Quadrant II, where there is prospective inhibition and retrospective activation, the relationships with the successful focal cease to have positive activation as the match progresses. This is probably due to an adaptation of the opposing team to the situations presented.

In this quadrant, there are relationships with the focal behaviour success with the attack phase (13.24), the own attack with the 3:3 system (11.26), and the opposing defence with the 6:0 system (10.60). We also found relationships with Zone 4 of completion (3.26), sequence 3 (2.25) and the penalty action (3.92).

If we look for the relationship with focal behaviour failure, we see that there are relationships with the opposing 3:3 offensive system (5.08), the own defence phase (9.79) and the goalkeeper's save (2.18).

Quadrant III (Prospective and retrospective inhibition):

In Quadrant III, the existing relationship is one of mutual inhibition. The behaviours analysed in this quadrant indicate that we did not achieve any benefit at any time during the match, so we could consider their usefulness.

The relationships we found with the focal behaviour success were circulation of a wing (3.18) and attack with a wing as a double pivot (6.41). At the defensive level, we observed a relationship with other defences (4.07), unstructured defence (7.53) and other defences by the opposing team (3.52). There was also a relationship with transition defence (8.67), Zone 2 (2.11), sequence 2 (2.39) and the throw-in without change of possession (2.07).

The relationships we found with the focal behaviour failure were inhibition in the 6:0 defensive system (9.82), the circulation of a wing (2.40), the double pivot attack by a wing (6.07) and the double pivot attack by a back (2.20) all by the opposing team. There is also a relationship in the counterattack phase (5.42), Zone 1 (2.24) and Zone 5 (2.46) finishing.

Quadrant IV (Prospective activation and retrospective inhibition):

In Quadrant IV, there is an asymmetrical relationship between prospective activation and retrospective inhibition behaviours. As the analysed category is realised, it becomes more effective in relation to the focal behaviour.

Regarding focal behaviour success, there is a relationship with the rival attack with the 3:3 system (5.29) and with the goalkeeper's save (2.52).

If we analyse the focal behaviour failure, can be observe relationships with the attack phase (12.75), the 3:3 offensive system (11.06) and other attacks (1.99). Additionally, with the opposing 6:0 defensive system (10.23), the finishing Zone 4 (3.54), the penalty action (3.97) and the interception and recovery of the ball (2.28).

4. Discussion

The aim of this study was to analyse the variables that influence success or failure in the different phases of the game in a season in an elite men's handball competition with polar coordinates. This analysis technique is novel for analysing all the variables that assess the performance of an elite men's handball team. There is research that has analysed with the same technique the performance of different factors at national team level in handball [8,23,32]. This technique has also been used in other sports with two other analysis techniques (T-Patterns and sequential analysis) to analyse fencing [46]. In basketball, this polar coordinates technique has also been used both in the analysis of the game [47] and in the analysis of coaches' responses [48].

In our research, on an offensive level, both in the positional attack phase and in the counterattack phase, success was understood as all actions that ended with a goal or where an advantage was achieved for the attacking team such as a disciplinary sanction of the opponent (yellow card, exclusion, or disqualification) or a clear action of completion such as a penalty. Failure was defined as any action where a shot was missed, either by a save by the goalkeeper or by throwing it wide, any defensive action that stopped the rhythm of play of the attack (foul), or the loss of the ball due to an opponent's interception or an own loss in a pass, for example.

To evaluate success in the defensive and transition defence phase, we defined it as any action that managed to recover the ball either by intercepting it, by a save or by a block. We also consider within success any action that stopped the rhythm of play of the rival attack (foul). All actions where a goal was conceded, a defensive player was penalised, or a clear penalty was awarded were defined as a failure.

In our search for references, we have not found any research where a regular season of an elite men's team is analysed in the different phases of the game through polar coordinates. From this analysis we have tried to find out which are the behavioural patterns that lead us to achieve our goals in the different moments of the game and the relationships with the different criteria of the game.

4.1. Defence

The observed team obtained a strong relationship in this phase with the focal behaviour success. The defence and, more specifically, the defensive system 6:0, were located in Quadrant I, demonstrating this mutual excitation between the two behaviours, confirming the behavioural relationship in Quadrant III with the focal behaviour failure. The system 6:0 was the most used in most of the team's games, data that have also been demonstrated in other research [8,9]. In turn, when the opposing team tried to overcome the defence with tactical actions common in handball such as the circulation of the wing, the transformation to double pivot by a wing or a first line, the defence was able to counter them efficiently. These data are also confirmed by the relationships obtained with the failure behaviour and the data from Quadrant III. In other research, they observed that attacks with transformation were more effective than those without [20]. This could be argued from our results due to an evolution of the current game, being more direct, with more possessions and faster actions that do not slow down the game as much [19]. If we analyse another habitual attack system, the attack 33 rival behaviour [9], we see that its location was found in Quadrant III in the success behaviour and in Quadrant II in the failure behaviour, indicating that, surely, as the minutes of the games progressed, the defensive system adapted better to this structured attack system, managing to counteract it and stimulate defensive success on the part of the team observed.

Different conditioned behaviours supported team success in this phase such as interception and block and their location in the first quadrant. Other research also showed that defensive performance was one of the indicators to adequately predict victory in a match at the men's national team [17] or club level [15].

When analysing the pace of play of the opponent's attack, it was observed that in Sequence 1, the team was able to stop the opposing team effectively, and also in Sequence 3, although it was losing its relationship with success as the match progressed. This relationship was also observed in different studies where the winning team made moves, forcing the opposing team to find worse finishing situations or areas [8,23]. However, other research also showed that stopping the attacking pace of the opposing team with successive fouls did not improve the success of the defence [16]. On the contrary, we were also able to observe that as the minutes progressed in the matches, more penalty actions were conceded, being a clear option of completion by the attacking team, bringing us closer to the focal failure behaviour.

The analysis has shown an important part of the success of a defensive system is related to the performance of the goalkeeper [12]. The data obtained showed that as the goalkeeper's performance improved, his relationship with success behaviour increased and decreased with failure behaviour. There is other research that supports these results, showing that the winning teams were those that achieved a greater number of saves by their goalkeepers [12,15], also demonstrated that the losing teams made more shots from areas far from the goal, being easier for the goalkeeper [15,23]. It was also observed that the goalkeeper's performance plays a decisive role in the final result [14], combined with adequate offensive efficiency [12].

The team was found to be more solid in its main defensive system, a formed and structured defence as when, for circumstances, it performed other defence or unstructured defence, the tendency was towards failure (Quadrant I), as demonstrated in other research where attacks were more successful in front of unorganised defences [10].

4.2. Counterattack

The fact that at the defensive level, the team observed had a significant relationship with success behaviour, influenced the relationships in this phase. Various studies have shown that good defensive efficiency leads to an increase in the number of counterattacks and a clear opportunity to shoot. This phase can start with ball stealing [11,17], a good performance by the goalkeeper [12,15] or a good relationship between defensive efficiency and the goalkeeper [26].

If we look at the relationship between the focal success behaviour and the conditioned behaviours counterattack and Sequence 1, we can deduce that the team analysed obtained a high performance in this phase, and that their game, linked to the previous phase, promoted trying to finish more actions in this phase than in the static attack. These findings follow the same line as other research that showed that counterattacking is commonly performed in Sequence 1 [8] and is often more successful than structured attacking as it is attacked against unstructured defences [10]. Other research showed that the difference between winning and losing teams was the goals scored in this phase [10]. Looking at the results obtained by the team in Table 1, it could be said that the observed team was clearly a winner.

The reason that the game model deduced from the team was based on an efficient defence that allowed for easier finishing options in the counterattack phase is surely due to the direct relationship of this phase with success in the match demonstrated in multiple investigations [10,14,17], but also with a direct relationship with success in the defensive phase [15]. To confirm this argument, the data obtained with focal failure behaviour and this phase also reaffirm this assumption.

4.3. Attack

The results obtained in the research confirm those found in other research. They also showed that winning teams were characterised by fast attacks and not by the prolonged and interrupted attacks more typical of losing teams [10]. In order to cut the pace of the game and increase the sequences, opposing defences tried to stop actions in Zone 2, the zone where the attack is created and where many free hits are usually produced. They also tried to lengthen the sequences so that they did not shoot easily in order to increase the error (Interception of Ball) [17,23]. Even so, it was not enough to slow down the attack of the team observed by looking at the results obtained in the matches analysed (Table 1).

It can also be observed that the team was losing effectiveness in its offensive system 33, the most used in other research [9], against the rival defence, making the attacking phase approaching failure and moving away from success. This loss of activation with success was probably caused by an adaptation of the opposing team's defensive systems, by an increase in turnovers, by the increase in fatigue as the game progressed on the part of the attack or by the differences in the score, and the offensive relaxation on the part of the team observed [49]. Another behaviour that confirms this tendency is Sequence 3, where as the game progressed, it became less related to success. The attack tried to overcome the rival structured defence with different tactical actions (circulate wing; wing to double pivot), but their relationship was closer to the focal behaviour of failure rather than success. Even so, the observed team's attack was superior to the opposing defence in general in the static phase, given the results obtained, confirming data from other research [15,17].

Where the team observed had the most problems was in attacking the opposing team's defensive system 5:1 or other defensive systems. It is curious that, analysing this data, the opposing teams did not use these systems to try to stop the team's offensive success. This greater opposition of the defensive system 5:1 by the attack is in line with the results obtained in other studies that obtained the same conclusions, being the system that generated the most problems for the attack, but being an alternative, not being the main defensive system, with a clear relationship with the score, being either very much in favour or very much against. It seems that teams used this system as a desperate measure to stop the opponent's static attack as observed in other research [9].

4.4. Transition Defence

Being a team that achieved a high level of success in the offensive phase, especially in the counterattacking phase, this phase probably did not occur too many times in the different matches, or its transition defence forced the opposing team not to carry out a large number of counterattacks. However, we must bear in mind that when this phase did occur, it was usually not very well organised, and the opposing team was successful.

This could lead us to believe that this phase should be improved as they are easy finishing options for the opposing team as well as the counterattack of the team analysed. Having demonstrated the effectiveness and importance of the counterattacking phase for success, we can understand that this phase is associated more with failure, in any team, however little happens, rather than success [10,14,17].

5. Conclusions

The analysis of success or failure in the different phases of the game in an elite men's handball match with polar coordinates suggests, as in other research, that one of the keys is the defensive phase: not conceding goals and recovering the ball. The counterattack, another key to obtaining clear goal scoring options, is also linked to recovering the ball. Success in these two phases is key to winning matches and being a winning team. This suggests that it is necessary to focus on training with a high pace of play, linking the different phases of the game to achieve the objectives set for the match, recovering the ball, and attacking with the shortest possible time in front of an unstructured defence. It is essential to know what the performance indicators are in order to improve the team's results. Therefore, it is necessary to train the different categories where there is an activation of success throughout the game or in those that improve performance as the game progresses and reduce failure with those that do not achieve success. One limitation we have encountered is the lack of existing research on the transition defence phase. Conclusions could be drawn in this phase by comparing what happens in the counterattack, but an in-depth analysis of how to counteract the success of the counterattack should be developed in future research.

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