NOTATIONAL ANALYSIS OF PRO KABADDI LEAGUE IN THE PERSPECTIVE OF THE TEAMS' ACHIEVEMENT

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Abstract

Introduction: There has always been a need to conduct studies to understand the underlying game characteristics of kabaddi sport, but the number of studies is insufficient. Hence the researcher took a novel approach to conduct the current research on Pro Kabaddi league tournament.

Aim of study: The study aimed to enhance the existing knowledge, to understand the game characteristics, and evaluate the significance of the observed parameters concerning the ranking of a team in the tournament.

Methods: Data from 653 matches were taken in this study from the official website of the Pro Kabaddi League, which was held for seven seasons. A total of 22 variables was formulated for the study. Descriptive statistics and bivariate correlation were calculated using IBM SPSS Version 25.0.

Results: Attack variables, total raids (819.44 ± 182.67), total raid points (353.43 ± 105.26), average raid points (18.19 ± 2.57), all out conceded (22.88 ± 6.79), total point conceded (616.93 ± 157.99), rate of successful raids (34.04 ± 5.59), rate of empty raids (43.35±5.78), etc., and defence variables, total tackles (445.99 ± 106.53), total tackle points (185.66 ± 49.01), average tackle points (9.62 ± 1.17), all out inflicted (22.88 ± 9.21), rate of successful tackles (38.08 ± 5.17), etc. were calculated. Two attack variables and six defense variables exhibited significant correlation with the result variable, i.e., ranking after league matches.

Conclusions: The results revealed that the defense variables might have contributed more to achieving top ranking in the Pro Kabaddi league tournament.

Keywords: Pro kabaddi league. Notational analysis. Attack variables. Defence variables

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Introduction

Kabaddi is a popular team contact sport primarily played in the Southern Asia. The origin of the Kabaddi sport can be traced back to ancient India. It is the most-watched sport in the Indian subcontinental right after cricket (Nambiar, 2016; Thomas et al., 2009). It is very popular across the whole country and in some states, Kabaddi is the official state game (Kabaddi Rules, 2018; Rules and Regulation of All Forms of Kabaddi Version 2.1.0, 2017). It is played in a rectangular-shaped ground split into two equal parts. Each team plays with seven players on the court for 40 minutes which is further divided into equal halves of 20 minutes each and 5 minutes break between two halves (Rules and Regulation of All Forms of Kabaddi Version 2.1.0, 2017). Kabaddi is played indoors as well as in outdoor conditions. Kabaddi doesn't require any special equipment like other games and sports. It demands great agility, speed, strength, power, and coordinative abilities (Choudhary et al., 2017; Jana, 2020). Affectionately it is known as the 'Game of masses' due to the energy and rush it gives the onlookers who submerge themselves into the game and give Kabaddi players the consolation they need (Mundayur, 2017). The kabaddi sport is not only a game of India; it has reached various other nations of the world. Kabaddi is recognized as the national game of Bangladesh and Nepal (Sharma, 2016). In 'Indonesia' it is known as 'Chub' and in 'Sri-Lanka', it is known as 'Gudu' (Akila & Chinnadurai, 2017).

Kabaddi was introduced worldwide during the 1936 Berlin Olympics, displayed by Hanuman Vyayam Prasarak Mandal, Amaravati, India (Shah, 2017). The game was exhibited in the Indian Olympic Games (Presently known as National Games) held in Calcutta in 1938 (Lekshman, 2016). In 1950 the All India Kabaddi Federation appeared and accumulated standard guidelines. The Amateur Kabaddi Federation of India (AKFI) was established in 1973 (Manohar, 2014). The AKFI had given a new shape to the rules and kept the privilege to adjust them. Kabaddi has not thought back from that point forward. Since then, various competitions have consistently been conducted everywhere throughout the nation. Although Kabaddi was exhibited in the 1936 Berlin Olympic Games, it still has to cross a long way to be inducted into the Olympic games.

Present-day Kabaddi is a union of different game formats which are played in different structures under different names in different places. Various advances had been taken to promote the game and dominate the hearts of more individuals around the world, and one of those is the inception of the Pro Kabaddi League. Pro Kabaddi League is a professional kabaddi competition, and its first season began in 2014 (Ghosh & Sarma, 2018) with only eight teams. The number of teams had reached twelve in further seasons. The shape of the tournament was impacted by 'Cricket's Indian Premier League. It was likewise a decent mechanism for coordinating with the players of different nations like Pakistan, Iran, South Korea, and so forth. Today, seven seasons of the Pro Kabaddi League have been completed.

Notational analysis in sports records players' activities depending on explicit markers concerning performance (Hughes, 2004; Minu et al., 2021). The historical backdrop of the sports notational analysis can be traced back to around fifteen centuries. Hughes, (2004) further clarified that movement notation systems had advanced to the zone of expressive movement and gradually transformed into sports and games analysis. Notational analysis can help identify physiological and psychological demands in games or sports competitions (Gogoi, Borah, et al., 2021; Sporis et al., n.d.). It helps in quantitative analysis. Recent methodological development in the notational analysis is helping researchers to address fundamental queries about games and sports competitions (Gogoi et al., 2020; Hughes et al., 2007). It assists the researchers in decoding the secret behind better performance. Apart from players' characteristics, in Kabaddi, teamwork is required among all team members (raiders and defenders) to stay on the court and compete. The number of players on the court fluctuates during the match, which directly affects the score, and it cannot be decided who will be the winner of the match until the match is over. So, there is a need for a study in Kabaddi to know about various factors which take the team towards victory. Hence, this quantitative analysis on the Pro Kabaddi league tournament has been conducted to understand the underlying factors of the kabaddi sport. This study will help the coaches and researchers, to understand the game characteristics of the Pro Kabaddi League matches and will also highlight the different factors, which contributed most to success in Pro Kabaddi League.

Materials and methods

Source of data*:* Data from all seven seasons of PRO Kabaddi League was collected for the study. Till the 4th session, the tournament was limited to only 8 teams but from the 5th session, the number of teams had increased to 12. A total of 60 matches was played in each season of the first four seasons. But in season 5 and 6 the number of matches per season had increased to 138. In season 7, the total no of matches played was 137. A total of 653 matches was played in overall 7 seasons out of which 240 matches were played in the first four seasons and the rest were played in the last three seasons. A total of 62 matches from all seasons have resulted in draw. All match reports of 653 matches were collected for the current study.

After every game, basic statistical reports (Figure 1) were publicly available on the official website (https://www.prokabaddi.com) of the Pro kabaddi league and those reports were used as the data source for the current study.

Procedure for data collection

Before data collection, variables were formulated in IBM SPSS variable view sheet. A total of 22 variables were formulated out of which 2 were basic variables for identification of teams and seasons, 1 was result variables, 12 were attack variables, and another 7 were defense variables. Classifications of variables can be understood in Table 1. For the basic match-related variables, data were the same as in the raw statistical report (Figure 1), but for the rest of the variables, data were calculated using appropriate mathematical formulas, as mentioned in Table 1.

Statistical analysis: Simple descriptive statistics were used using minimum, maximum, mean, and standard deviation to understand the game characteristics of the Pro Kabaddi League tournament. The bivariate correlation technique was used to find the relationship between selected variables with the performance variable (Verma, 2013). IMB SPSS Version 25.0 was used to apply all statistical tests.

Results

Attack variables: The results shown in Table 2 display the descriptive statistics of all selected attack variables. From Table 2, it can be seen that in overall seven tournaments average of 819.44 ± 182.67 raids were conducted by any team out of which an average of 353.43 ± 105.26 raid points was collected. Per match average raid point was 18.19 ± 2.57 for any team. In 22.88 ± 6.79 instances, all out conceded occurred for a team. Average 616.93 ± 157.99 points were conceded by opponent teams. The rate of the successful raid was 34.04 ± 5.59, whereas the rate of the empty raid was 43.35 ± 5.78. The average rate of super raids was .23 ± 0.50. The rate of raid points was 42.81 ± 6.81. Average 8.49 ±1.93 points were collected in doing or die raid conditions. The average rate of raid touch point was 33.62 ± 5.60, and the rate of raid bonus point was 9.31 ± 3.14.

The relationship of the ranking after league matches with selected attack variables is displayed in Table 3 as a correlation matrix. Table 3 reveals a strong significant positive relationship between ranking after league matches and all out conceded ($r=0.392$, $p<0.01$). In contrast, it was also revealed that the rate of raid touch point has a moderate negative relationship with ranking after league matches ($r= -0.268$, $p<0.05$). None of the other attack variables were significantly associated with ranking after league matches.

Defense variables: Table 4 presents the descriptive statistics of all selected defense variables. Per team average tackle attempt was 445.99 ± 106.53 with a successful tackle rate of 38.08 ± 5.17 and an average tackle point of 9.62 ± 1.17. Per match 185.66 ± 49.01 total tackle points were collected by any team. In 22.88 ± 9.21 instances, a team all out inflicted the opponent team. The average rate of successful tackle was 3.79 ± 1.44 and the overall average rate of tackle point was 41.68 ± 5.31.

The displayed result in the correlation matrix (Table 5) between ranking after league matches and other defense variables reveals that the average tackle point ($r= -0.322$, $p<0.01$), all out inflicted ($r= -0.550$, $p<0.01$), rate of successful tackle ($r= -0.482$, $p<0.01$) and rate of tackle point ($r= -0.400$, $p<0.01$) have a strong negative correlation with ranking after league matches. On the other hand, variables total tackle points ($r= -0.273$, $p<0.05$) and rate of super tackle ($r= 0.263$, $p<0.05$) display a moderate correlation with ranking after league matches. The variable total tackle didn't display any significant relationship with the dependent variable.

Discussion

The current research was one of its kind about the Pro kabaddi tournaments. Therefore, there was not much previous literature available. The present study draws out various descriptive explanations of the Pro kabaddi league tournament. It also explains the relationship of various variables with

TEAM STATS

	SEASONS	OVERALL	SEASON 7	SEASON 6	SEASON 5	SEASON 4	SEASON 3	SEASON 2	SEASON 1
OVERALL	MATCHES PLAYED	129	24	23	24	14	16	14	14
	WINS	59	16	12	11	3	9	4	4
	DRAWS	15	3	2	6	2	0	1	1
	LOSSES	55	5	9	7	9	7	9	9
	FINISHING POSITION	-	2	2	1	8	4	6	7
	HIGHEST SCORE	48 vs	48 vs	44 vs	44 vs	34 vs	37 vs	39 vs	42 vs
	BIGGEST WINNING MARGIN	31 (17 vs 48)	31 (17 vs 48)	16 (39 vs 23)	20 (40 vs 20)	8 (31 vs 23)	17 (34 vs 17)	3 (17 vs 20)	5 (40 vs 35)
ATTACK	TOTAL RAIDS	5481	994	963	1079	602	702	595	546
	SUCCESSFUL RAIDS	1860	414	340	379	167	213	134	213
	UNSUCCESSFUL RAID	1181	191	201	223	125	144	151	146
	EMPTY RAIDS	2440	389	422	477	310	345	310	187
	SUCCESS RAID %	42%	52%	45%	42%	34%	36%	31%	52%
	NO. OF SUPER RAIDS	71	16	16	11	4	4	9	11
	RAID TOUCH POINTS	1819	416	341	333	154	204	151	220
	RAID BONUS POINTS	504	97	95	122	48	46	33	63
	TOTAL RAID POINTS	2323	513	436	455	202	250	184	283
	TOTAL TACKLES	2941	578	508	521	318	329	306	381
	SUCCESSFUL TACKLES	1060	217	186	181	117	137	116	106
	UNSUCCESFUL TACKLES	1881	361	322	340	201	192	190	275

Figure 1: Team statistics report of PRO Kabaddi league tournament (Screenshot from https://www.prokabaddi.com).

Table 1: Classification of variables and their explanation.

Variable types	Variable names	Explanation
General variables	Team	Total 12 teams
	Season	Total 7 seasons
Result variables	Ranking after league matches (RL)	Ranking of a team after completion of league matches
Attack variables	Total raids (TR)	Total number of time team sends the players to opponent side to collect points.
	Total raid points (TRP)	Total points taken by a team by sending the players in opponent's side either in the form of bonus or touch points.
	Average raid points (ARP)	Average raid point scored by a team
	All out conceded (AOC)	Number of times whole team is put out by opponent's team
	Total point conceded (TPC)	Sum of all the points taken by the opponent team in the form of raid, tackle, technical or extra pints
	Rate of successful raids (RSR)	Successful raid is when raider comes to his side safely by taking point from opponent team. Rate of successful raids is the calculated rate of successful raids. (RSR= Successful Raids/ Total Raids)
	Rate of empty raids (RER)	Empty raid is when raider comes to his side safely without taking point from opponent team. Rate of empty raids is the calculated rate of empty raids. (RER= Empty Raids/ Total Raids)
	Rate of super raids (RSUR)	Super raid is when raider scores three or more points in one raid. Rate of super raids is the calculated rate of super raids. (RSUR= Super Raids/ Total Raids)
	Rate of raid points (RRP)	Calculated success rate of raid points. (RRP= Total Raid Points/ Total Raids)
	Rate of do or die raid points (RDDRP)	Do or die raid points are taken by the teams by sending the raider in opponent's side either in the form of bonus or touch point in a special condition in which raider can-not come into his side without taking a point and if raider comes to his side without taking a point, the raider will be considered out. Rate of do or die raid points is the calculated rate of do or die raid points. (RDDRP= Do or Die Raid Points/ Total Raids)
	Rate of raid touch points (RRTP)	Raid touch point is when raider comes to his side safely by touching player/players of opponent side. Rate of raid touch points is the calculated rate of raid touch points. (RRTP= Raid Touch Points/ Total Raids)
	Rate of raid bonus points (RRBP)	Raid bonus point is when raider takes bonus point by crossing the bonus line of opponent's side. Rate of raid bonus points is the calculated rate of raid bonus points. (RRBP= Raid Bonus Points/ Total Raids)
Defence variables	Total tackles (TT)	Total attempts to catch the opponent's raider in own side
	Total tackle points (TTP)	Total points taken by catching the opponent's raider in own side in the form of tackle, super tackle.
	Average tackle points (ATP)	Calculated average tackle points by a team.
	All out inflicted (AOI)	Number of times a team manages to put out all players of opponent team
	Rate of successful tackles (RST)	Successful tackles are the successful attempts to catch opponent's raider in own side. Rate of successful tackle is the calculated rate of successful tackles. (RST= Successful Tackles/ Total Tackles)
	Rate of super tackles (RSUT)	Super tackle is when a team caught opponent's raider in own side when only three or less players were present on the mat. Rate of super tackle is the calculated rate of super tackles. (RSUT= Super Tackles/ Total Tackles)
	Rate of tackle points (RTAP)	Tackle points are the points taken by catching the opponent's raider in own side in the form of tackles, super tackles. Rate of tackle points is the calculated rate of tackle points. (RTAP= Tackle points/ Total Points)

Table 2: Descriptive statistics of attack variables.

Variable	Minimum	Maximum	Mean	Std. Deviation
Total raids (TR)	546.00	1173.00	819.44	182.67
Total raid points (TRP)	184.00	637.00	353.43	105.26
Average raid points (ARP)	13.14	24.50	18.19	2.57
All out conceded (AOC)	12.00	37.00	22.88	6.79
Total point conceded (TPC)	397.00	921.00	616.93	157.99
Rate of successful raids (RSR)	22.52	47.80	34.04	5.59
Rate of empty raids (RER)	31.13	54.44	43.35	5.78
Rate of super raids (RSUR)	0.44	2.39	1.23	0.50
Rate of raid points (RRP)	30.92	59.05	42.81	6.81
Rate of do or die raid points (RDDRP)	4.78	13.57	8.49	1.93
Rate of raid touch points (RRTP)	24.30	51.14	33.62	5.60
Rate of raid bonus points (RRBP)	4.11	18.35	9.31	3.14

performance in Pro kabaddi league tournaments. To date, such kind of study on the kabaddi game has been conducted only by (Bagchi et al., 2019; Parmar, 2018; Ram & Singh, 2021a, 2021b). Bagchi et al., (2019) developed a logistic regression model in which all out point, tackle point, and raid point were found as significant predictors for performance in the sport. (Parmar, 2018) suggested implementing his result to develop in game-winning predictions which can be further used in tactical decision-making during a game situation. In other games and sports (Barreira et al., 2016), a similar kind of notational analysis was conducted to analyze the relationship between point differences at different phases of badminton play with the result of the game. Abdullahi & Coetzee, (2017) advised using computerized notational analysis to determine different characteristics of badminton sport. In another study, Thomas et al., (2009) tried to develop a notational analysis system to investigate some selected soccer skills. The same study also investigated whether those skills are related to success in the game.

Further, they tried to develop a statistical model to find how they are important to score a goal. In handball, Ferrari et al., (2018) tried to develop and validate a notational test to investigate the offensive process during play. Apart from the whole game or sport, many pieces of research were confined to particular skills. Zahidi & Ismail, (2018) tried to relate successful and unsuccessful evasive soccer skills with short outcomes; on the other hand, Hasnor et al., (2018) conducted a study on tactical passing skills of collegiate-level indoor hockey players. Gogoi & Acharya, (2019) mentioned that such analysis could help to identify a player's strong and weak aspects of gameplay, and subsequently, they can use that result to formulate appropriate game strategies. Lupo et al., (2010) also said that notational analysis is a valuable tool for better and effective coaching.

Table 3: Correlation matrix of attack variables with result variable.

	RL	TR	TRP	ARP	AOC	TPC	RSR	RER	RSUR	RRP	RDDRP	RRTP	RRBP
RL	-												
TR	-.208	-											
TRP	-.235	.871**	-										
ARP	-.210	.338**	.739**	-									
AOC	.392**	.629**	.586**	.261*	-								
TPC	.016	.921**	.915**	.500**	.810**	-							
RSR	-.164	.293*	.691**	.949**	.257*	.470**	-						
RER	-.101	-.220	-.603**	-.843**	-.409**	-.484**	-.917**	-					
RSUR	-.165	-.092	.171	.447**	-.121	-.011	.294*	-.239	-				
RRP	-.157	.216	.654**	.971**	.216	.417**	.972**	-.904**	.447**	-			
RDDRP	-.170	-.227	-.498**	-.618**	-.465**	-.461**	-.727**	.857**	.026	-.675**	-		
RRTP	-.268*	.065	.498**	.899**	-.063	.201	.885**	-.776**	.513**	.927**	-.499**	-	
RRBP	.111	.173	.297*	.319**	.402**	.317**	.357**	-.377**	.052	.359**	-.482**	.116	-

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 4: Descriptive statistics of defence variables.

Variable	Minimum	Maximum	Mean	Std. Deviation
Total tackles (TT)	274.00	625.00	445.99	106.53
Total tackle points (TTP)	100.00	289.00	185.66	49.01
Average tackle points (ATP)	7.14	12.57	9.62	1.17
All out inflicted (AOI)	9.00	55.00	22.88	9.21
Rate of successful tackles (RST)	25.27	49.54	38.08	5.17
Rate of super tackles (RSUT)	1.37	8.13	3.79	1.44
Rate of tackle points (RTAP)	29.08	53.85	41.68	5.31

Table 5: Correlation matrix of defense variables with result variables.

	RL	TT	TTP	ATP	AOI	RST	RSUT	RTAP
RL	-							
TT	-.118	-						
TTP	-.273*	.886**	-					
ATP	-.322**	.266*	.615**	-				
AOI	-.550**	.671**	.725**	.393**	-			
RST	-.482**	.004	.440**	.790**	.356**	-		
RSUT	.263*	-.135	-.017	.151	-.338**	-.024	-	
RTAP	-.400**	-.043	.414**	.809**	.253*	.965**	.236	-

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

In the current study, the results indicate that from average 819.44 ± 182.67 total raids, a team managed to obtain average 353.43 ± 105.26 total raids points in which per match average raid point was 18.19 ± 2.57. On average 34.04 ± 5.59 percent of total raids, raider comes to his side safely by making point/points from the opponent team, whereas in 43.35 ± 5.78 percent of total raids raider comes to his side safely without making any point from the opponent team. In 1.23 ± 0.50 percentage of total raids, the raider scores three or more points from the opponent team. The percentage of do or die raid points was 8.49 ± 1.93, which was in a special condition of the raid when the raider can-not come into his side without taking any point either in the form of bonus or touch point. In 33.62 ± 5.60 percentage cases, the raider collected the points by touching the opponent player/players and safely returned to his side. On the other hand, the rate of the raid bonus point was 9.31 ± 3.14 in which the raider takes bonus points by touching the bonus line of the opponent's side. Average 22.88 ± 6.79 instances whole playing members of a team were put out by the opponent's team. The collective points of the opponent team in the form of the raid, tackle, technical, or extra point were 616.93 ± 157.99.

Further, it was revealed that 445.99 ± 106.53 times a team attempted to catch the opponent's raider on their side in the form of tackle and super tackle, from which a team collected 185.66 ± 49.01 cumulative tackle points. The per match average tackle point was 9.62 ± 1.17. It was also reported that 22.88 ± 6.79 times a team manages to put out all players of the opponent team. The rate of successful attempts to catch the opponent's raider in own side was 38.08 ± 5.17. The result of the study also revealed that in 3.79 ± 1.44 percentage of total raids, a team caught the opponent's raider on its side when only three or fewer players were present on the mat. The calculated rate of tackle points was 41.68 ± 5.31 per team. It has been found that there is a positive correlation (r=0.392, p<0.01) between ranking and the variable all out conceded. It indicates that the teams that were put out by opponent teams for less number of times were in top-ranking after league matches. It was also found, that there is a negative correlation (r= -0.268, p<0.05) between the variable rate of raid touch points with ranking after league matches. It indicates that the teams with a higher rate of raid touch points were in top-ranking after league matches. The significant negative correlation (r= -0.273, p<0.05) of the variable total tackle points with ranking after league matches indicates that the teams which got higher tackle points tend to possess top ranking after league matches. Another significant negative correlation (r= -.322, p<0.01) between average tackle point and ranking after league matches suggests that having a higher per match average tackle point was a significant factor for top ranking after league matches. The ability to put out all opponent team players and collect points for it was also an important factor in achieving top ranking in the tournament. There was a significant negative correlation (r= -.550, p<0.01) between all out inflicted and ranking after league matches which indicates that the teams which were able to put out all players of the opponent team for the higher number of times were tend to get top ranking after league matches. Another significant negative correlation (r= -.482, p<0.01) of the rate of successful tackles with ranking after league matches indicates that successful tackles were an important contributor to achieving top ranking. The rate of tackle point also exhibited a significant negative correlation (r= -.400, p<0.01) with ranking, and it suggested that tackle points were an important factor in achieving high ranking. Those who were having high tackle points tend to achieve top ranking after league matches.

Conclusions

The game kabaddi was once considered as a native Indian game and was

popular mostly in rural India. But induction of PRO kabaddi league had changed the scenario. Rules were unified to be entertaining and proactive steps were taken to make it popular all around the world. As the popularity of the game increases, the teams are using cutting-edge methods to find the best possible way to achieve the championship trophy. Dedicated research was also being conducted to improve the players' performance, but a few had tried to address the issues like notational analysis of the Pro kabaddi league to understand the underlying factors of the tournament. Therefore, the researcher conducted this study to analyze the tournament quantitatively for a better understanding of the game characteristics of the Pro kabaddi league. The study's result will help deepen the knowledge of the game, which may further help formulate game tactics according to it. Coaches may use the result to identify the factor contributing most to winning or achieving a higher ranking. The result revealed that the defense variables might have contributed most to attain top ranking in the Pro kabaddi league tournament.

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Conflict of interest

The authors declare no conflict of interest.

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