Lokaverkefni B.Sc. í íþróttafræði

Fram á síðustu stundu

A statistical analysis on Fram Football Club´s 2022 season

Maí, 2023

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12 ECTS ritgerð til B.Sc. í íþróttafræði

Abstract

This study looked at the 2022 season for Fram Football Club in Besta Deildin, the top tier of Icelandic club football. It sought to explain why Fram kept dropping points in the final 15 minutes of matches. This two-part study first aimed to establish the existence of the problem, by analysing goal timing distribution in the whole league and comparing it to Fram. The second part of the study aimed to analyse what the cause of the problem might be, which was done by looking at certain performance indicators in distinct parts of the game. From the 1st minute to the 75th minute and from the 76th minute to full-time to compare the performance in those two parts. This study found that Fram goalscoring in the final 15 minutes was significantly different from their expected value. The causes of the problem remain unclear even though the results of the second part of this study may hold some clues. For further research, a more comprehensive approach is needed, considering more possible contributing factors than was done in this study.

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Introduction

In the 2022 season in Iceland's top flight football division, no team conceded more goals in the final 15 minutes (and stoppage time) of games, then Fram Football Club. During the same season, Fram Football Club also had the joint lowest number of goals scored. At the end of the previous season, the 2021 Icelandic club football season, Fram Football Club got promoted from the second tier to Besta Deildin, the top tier of Icelandic club football. Despite their promotion, they were widely expected to be relegated back from Besta deildin in the following season in 2022. Despite the expectation of their relegation, they ended the regular season in 8th place, effectively saving themselves from relegation.

Fram Football Club's playing style for the 2022 season was characterised by free-flowing and entertaining football play. During the season, Fram Football Club's games included the most goals, scored and conceded, of any team in the league. In 22 games, Fram Football Club scored 44 goals, the 4th most in the league. Meanwhile, they also conceded 51 goals. The only team to concede more goals in the 2022 season was Íþróttafélag Akranesar (ÍA). At the end of the season ÍA sat at the bottom of the league table and were relegated.

The purpose of this study is to compare goal distribution in Fram Football Club (or thus forth referred to as Fram) matches to the normal goal distribution for the rest of the league. As well as to compare some of the performance indicators from the first 75 minutes of the games to the last 15 minutes in each of Fram Football Club's first 22 games of the 2022 season.

Besta Deildin introduced a new format to the league for the 2022 season. The league consists of 12 teams, as it has for approximately the past decade. Each season, every team plays home and away against every team, which comes down to 22 games per team. The 2022 season introduced a new system, in which after each team had played its initial 22 games, the league was split into a top six and a bottom six. The new format then initiated a single round played

between the top six and the bottom six. This added five extra games to the season for each team. The final total of games for each team for the 2022 season was therefore 27 games in total. This study will only look at the first 22 games, as the sample size of 22 games was deemed sufficient for the purpose of this study.

The first step to solving the problem of why Fram Football Club concedes the most amount of goals and scores the least in the final 15 minutes (including stoppage time) is to recognise that there is a problem to solve. To establish the existence of this problem, the first part of this study aims to compare goal distribution in Fram's matches to the rest of the league in the first 22 rounds, to determine if there is a significant difference. The second part of this study focuses on analysing the data to establish what is causing the difference in goal distribution.

To do so the second part of this study aims to examine certain performance indicators and compare their prevalence in the first 75 minutes of a match to the last 15 minutes to see if they contribute to Fram's known problem of dropping points in the final minutes of a match. The following chapter will introduce the concept of performance analysis in football as well as detail its history and significance. Next common performance indicators in football will be introduced and discussed. The significance of the final fifteen minutes of a football match will be presented and finally, the concept of goal distribution will be outlined.

History, progress, and purpose of performance analysis in football

Performance analysis is the process of identifying and evaluating the strengths and weaknesses of your team, or the opposing team, as well as understanding the strategy of your opponent to devise a winning game plan. Performance analysis is considered very useful to help identify areas of the game that need to be improved or to identify weaknesses in your rival's game that can be exploited. The main reason for performance analysis in sports is to develop a better

understanding of the game which can help enhance performance with better-informed decision-making due to the knowledge gained from the analysis (O'Donoghue, 2009)

Traditional analyses are based on manual notation, where an analyst would watch a game and record events such as passes, shots, tackles, and fouls on paper. Watching a game live and having to count every pass, shot, and tackle, and noting them in real-time requires a tremendous amount of focus. Video recording has made it easier to record and subsequently analysing sporting events more accurately. Being able to rewind and take a closer look at unclear incidents has made it possible for analysts to make more accurate examinations. Despite the assistance that video recording has allowed, manual notation continues to be very time-consuming, prone to errors, and gives limited insights into the game (Gong et al., 2019). The reliability of notational analysis can be affected by the number of variables, such as the observer's skills, level of experience, as well as the observer's view of the events he is noting (Duthie et al., 2003).

Hand notation systems and comprised notation systems have now been applied to virtually all sporting situations and events. It has become hard to distinguish between hand notation and computerised notation as most hand-compiled data is usually processed in computerised systems such as Excel (Hughes & Franks, 2004). Notational analysts are concerned with the analysis and improvement of sports performance through the study of the data compiled during sporting events. Hughes lists four major purposes of notation: analysis of movement, tactical evaluation, technical evaluation, and statistical compilation (Hughes & Franks, 2004). The most generic form of data analysis in notation studies is to record frequencies of actions and their respective positions on the performance area; these are then presented as sums or totals in each respective area (Hughes & Franks, 2004).

In 1983, Ian. M. Franks and his colleagues saw the potential in computerised systems for data analysis and predicted that team sports would benefit immensely from the development

of these systems (Franks et al., 1983). Time has revealed that these predictions were correct. The traditional systems were concerned with statistically analysing events that were manually recorded. However, the introduction of computerised systems resolved the known issues of hand notation by allowing the game to be digitally represented through direct data collection onto computers. Subsequently, the game could be documented and analysed using the compiled data. This method offered a significant advantage as it represented the entire game which can then be digitally stored for further analysis. The initiation of a database through this process became a powerful tool once the computerised data analysis program was able to accurately analyse the compiled data (Hughes & Franks, 2004).

Notational analysis and performance analysis are closely related but not the same. The key difference is found in their focus and scope. While notational analysis primarily focuses on the systematic recording and analysis of specific events and actions (Hughes & Franks, 2004), performance analysis takes a broader perspective and includes a wider range of factors influencing performance. Performance analysis includes not only the analysis of specific events but also broader aspects such as physical conditioning, technical skills, psychological factors, team dynamics, and overall performance metrics (Arastey, 2020). The notational analysis is one aspect of performance analysis.

> Seldom can the birth of a new activity be pinpointed with any accuracy, but at 15.50 on 18 March 1950, a spectator at Swindon Town's home game against Bristol Rovers took a pencil and notebook out of his pocket. Wing Commander Charles Reep was at that moment beginning to create the first comprehensive notational analysis system for football. In the years that followed, he quickly saw how the information he was collecting could be used to plan strategy and analyse performance. He soon became the

> first professional performance analyst in football and later co-authored the first scientific paper to apply statistical analysis to football. (Pollard, 2002)

Charles Reep is considered by many to be the father of football analysis. In 1950, he was ahead of his time with his ideas and theories which he initially developed during his viewing of a Swindon Town match. While this was not known at the time, subsequent development in the field of football analysis has concluded that he was a pioneer in the field (Pollard, 2002). In the decades since Reep made strides in the field of football analysis, performance analysis has become a crucial aspect of modern-day competitive football.

Since Charles Reep visited Swindon Town's home ground in 1950, the methods of conducting performance analysis and gathering data have progressed significantly. Most of the elite clubs in Europe employ teams of analysts (Lewis, 2014). The semi-pro clubs, like most teams in the Icelandic top division, are slowly leaning in the same direction, even though they are unlikely to have the financial means to hire multiple employees in full-time positions in the foreseeable future, as is the case for the elite clubs. For most Icelandic clubs it still comes down to the coaching staff to conduct most of the performance analysis.

Over the past few years, the use of video tagging technology and computerised systems has revolutionised the field of performance analysis (Lewis, 2014). Computerised systems are software programs that capture and analyse performance data from matches automatically. With this technology, it is possible to collect vast amounts of data quickly and accurately (Beato et al., 2018). Video tagging technology allows specific events in a match to be tagged in a match video recording and data related to these events to be extracted using this software. It enables analysts to provide feedback to coaches and players, with video clips of specific events, with the aim to improve the way they deal with identical or similar incidents in future matches (Mackenzie & Cushion, 2012).

Another revolutionary aspect of performance analysis is the use of tracking data. The use of player-worn devices that combine both global positioning system and inertial monitors, have become a standard for professional teams, and are increasingly being used by semi-professional clubs. The player-worn devices most often are in the shape of a vest adorned by the player. The tracking data can provide valuable information about players' movements and actions during training and competitive matches. The vests can gather data on running distances and running speed, as well as the number of sprints taken. They also provide a tactical insight by recording the positioning and movement of each player and the team as a whole, throughout the game.

Recent interest in performance analysis has focused on the usage of these GPS vests in using the data generated to track training load (Theodoropoulos et al., 2020). Data compiled from the GPS vests may enable coaches to set up more efficient training plans, and if needed even personalise the training load for each player. Having reliable data that can validate how much the training load is, and how each player is reacting to it can potentially be very useful in managing injury risk (Theodoropoulos et al., 2020).

The training load can be measured as an external load and an internal load. External load is the tasks performed by the athlete, such as distance covered, number of sprints, and related variables. Before the introduction of the GPS vests, measuring external workload could be very time-consuming or inaccurate, or even both. The internal training load refers to the athlete's physiological response to the external load. Internal load is typically measured using the rating of perceived exertion (RPE). In the use of RPE scales the athlete rates the level of the physical difficulty of the training on a fixed scale. Heart rate monitors are also used to measure internal training load and they are often built into the GPS vests for that purpose. The Borg RPE scale is designed to correlate with heart rate. That scale ranges from 6 to 20. Six being no effort at all and twenty being maximum effort. The idea of this scale is that by

multiplying the RPE level by 10, that should be close to equalling the heart rate (Williams, 2017). Having those measurements of external and internal training load can be of great value to the coaching staff.

In a famous press conference held by Marcelo Bielsa, then manager of Leeds United, on January 16, 2019, after being accused of spying on his opponents, he admitted to that. He had been spying on opposition training sessions before every game, using scouts (Salt, 2019). He did not do this press conference to apologise for his behaviour, but instead, he had a 70-minute briefing with a PowerPoint show, to explain how he prepares his team for matches (Salt, 2019). He revealed that his staff spends over 200 hours analysing each opponent (Salt, 2019). That is an example of the effort put in by the elite clubs in trying to gain an advantage over their opponents through analysation.

Identifying and categorising performance indicators

Analysing and evaluating team and individual performance in football is very complex and multiple factors need to be considered. It is much more difficult to appraise performance in football than individual sports such as for example track-and-field athletics, rowing, skiing, and swimming. In those individual sports, all individuals can be judged on their finishing position (Reilly, 2005).

As it is in most sports, winning is the objective of football. To win a football match, the team must score more goals than their opponent. However, a good performance cannot guarantee a good result, but a good performance will increase the chances of a positive outcome. Chance often plays a part in crucial events of the game; for example, in scoring or conceding a goal, scoring own goals, making a fluke deflection, or even a defender slipping at a crucial moment (Reilly, 2005). That is one of the reasons why we might hear coaches or managers claim in post-match interviews that they were the better team, despite losing the match. In many cases that might be a biased opinion, based on personal feelings. But in some cases, such a claim

might be backed up by relevant stats from the match. The better team (based on the statistics of the game) does sometimes lose, but as Sir Francis Galton explained, everything regresses to the mean (Ethington et al., 2002). That means if a team keeps performing well, positive results will eventually follow.

To be able to judge a team's performance on something other than match results. Key performance indicators need to be identified. Performance indicators in sports can be split into four categories: tactical, technical, physiological, and psychological. Those categories can then be further split into other subcategories (Hughes et al., 2012).

Tactical performance indicators are indicators that relate to strategies and decisions made in the game by teams as well as individual players. They measure the player's ability to execute tactical plans, read the game, and make effective decisions. The traditional frequency variables for tactical insights are factors like ball possession percentage and pass success rate. But over the years, tactical analysis has become much more advanced giving even deeper insights into the game. Possible measurable tactical variables are countless. An example of how expansive tactical measurements has become is shown in research from 2017, where positional data can be used to analyse relevant information like player coordination, team coordination, and the average position of the defensive line (Memmert et al., 2017).

Tactical factors are often based on sequentially dependent data. The sequence forms a set pattern with respect to position, player, or, most frequently, time (Hughes & Franks, 2004). Meaning that they aim to analyse patterns in play rather than specific events. Tactical performance indicators seek to reflect the relative importance of the use of pace, space, fitness, and movement, and how players use these aspects of performance, of themselves and their opponents, targeting the technical strengths and weaknesses of the respective performers (Hughes & Franks, 2004). In a study from 2020 that analysed defensive tactics used by teams in Spanish La Liga, it was found that defensive tactics employed by teams were different

depending on match status and the quality of the opposing team (Fernandez-Navarro et al., 2020).

Technical performance indicators relate more to individual players' skills and abilities to perform specific actions on the pitch, such as pass completion rate, successful dribbles made, key passes per game, and more. The relevant technical performance indicators for a player will depend a lot on his playing position and the tactics of the team. Different qualities are required for different positions on the field, as well as in different playing systems (Poli et al., 2016).
The third major group of performance indicators is those measuring physiological performance. Those indicators relate to a player's physical capabilities and fitness levels. They measure for example running distance and intensity of the runs. With the use of GPS vests, this data has become easy to collect. When analysing the data collected with the GPS tracking it is important to understand that different playing positions have different physical demands (Bloomfield et al., 2007).

Finally, performance analysis also measures psychological performance indicators. They relate to the player's mental abilities. Ability to perform under pressure, mental toughness, decision-making abilities, and so on. Those indicators can be hard to measure. Assessing the extent to which psychological factors influence performance in a soccer game can aid in enhancing a player's abilities and capabilities (Abdullah et al., 2016).

These four main categories of performance: analysis, tactical, technical, physiological, and psychological, are not mutually exclusive and may overlap. In this study only tactical and technical indicators will be studied, and how they differ between intervals in the game considered. However, it is important to keep in mind that team performance is a complex and dynamic system, and all aspects of that system are interrelated.

Final fifteen

Professional and semi-professional football games are made of two 45-minute halves that make up a 90-minute game. Each game then has additional minutes added to it to account for game stoppages caused by numerous events such as player stalling or injury, these additional minutes are referred to as stoppage time. When a match nears its conclusion, teams become more desperate to secure favourable results. This desperation may lead to a change in intensity and urgency from both sides. The leading team often becomes more passive and the trailing team turns more aggressive.

The leading team may attempt to slow down the tempo of the match, deliberately wasting time to eat up seconds of the clock. While the losing side will try to quickly minimise stoppages in the game, to maximise their chances of scoring an equaliser or a winning goal. Even though the intensity may increase, fatigue unavoidably comes into play during the final minutes of the game. The physical demands in football have been studied intensively and fatigue develops during and toward the end of the match (Bangsbo et al., 2007).

Fatigue can be both mental and physical. Mental fatigue is generally recognized as a complex psychological phenomenon. It is a condition of fatigue caused by an increase in the demand for cognitive activities (Sun et al., 2022). The state of mental fatigue has been shown to significantly affect the technical performance of football players, leading to more errors being made (Sun et al., 2022). Another study found mental fatigue to impair executive functions, with accuracy in passes and shots decreasing and performance time increasing (Sun et al., 2021).

A difference can also be found in running performance in the last 15 minutes of a game compared to the previous 75 minutes. A study monitoring 36 professional footballers running performance in 15-minute intervals of the game suggested that time-dependent reductions in

distances covered that acceleration and deceleration capability were acutely compromised during match play (Akenhead et al., 2013).

Numerous psychological factors are also worth consideration. The effect of nervousness and pressure, even though those factors might be persistent throughout the whole game, are likely to maximise towards the end of the game. The outcome of the match becomes more significant, and the weight of the situation can affect player decision-making, composure and mistakes may occur more often. Regardless, some players or teams might excel under pressure, displaying what analysts refer to as mental resilience.

Athletes, coaches, and applied sports psychologists have consistently referred to mental resilience or toughness as one of the most important psychological characteristics related to outcomes and success in elite sports (Crust, 2007). Despite the undebatable importance of mental toughness, an official or universally accepted definition of the term does not exist. Researchers and theorists have defined mental toughness in terms of coping effectively with pressure and adversity so that performance remains minimally affected (Clough et al., 2002).

Goal distribution

If the timing of goals were completely random, it could be assumed that the distribution would be roughly even across every minute of the game but that is not the case. There can be numerous factors contributing to goal distribution. When the goal timing distribution is examined in the top leagues of European football, a similar trend in distribution can be found in most of them. In the English premier league 2021/2022 season. 45,2% of goals were scored in 1st half, 54,8 in the second half, and 22,4% of all goals came after the 75th minute, or in the final 15 minutes (*Time of Goals*, n.d.).

English Premier League, Serie A in Italy, La Liga in Spain, Ligue 1 in France, Bundesliga in Germany, and more, all show that more goals are scored in the second half than in the first half. The statistics also show that more goals are scored in the final 15 minutes than

in any other 15-minute segment in the game. However, it's worth noting that the last 15-minute segment includes the added stoppage time that may cause inflation to the numbers (*Time of Goals*, n.d.).

In an Analysis of Goal Scoring Patterns in the 2012 European Football Championship, a similar trend was found as well. 57,9% of goals were scored in the second half, and 21,1% in the final 15 minutes (Armatas & Mitrotasios, 2014). Another study analysing goal-scoring patterns in four of Europe's top leagues for 3 consecutive seasons, also found a significant difference in the number of goals scored in each half. 44,9% in the first half and 55,1% in the second half, and 20,2% of all goals were scored in the final 15 minutes (Alberti et al., 2013). Studies on goal distribution thus clearly demonstrate that the final 15 minutes of a football game can be detrimental to the final outcome of the game (Alberti et al., 2013; Armatas & Mitrotasios, 2014; *Time of Goals,* n.d.), whether it is because a game-winning goal is scored or a game losing goal conceded.

Material and Methods

Material

The material is Fram Football Club's first 22 matches of the 2022 campaign. Video recordings of each game, as well as official match reports, were compiled for analysis. Additionally, the goal distribution for matches of the whole league was used.

Methods

Analysing goal timing distribution

This study is divided into two parts. The first part was to determine if Fram's problem of conceding too much and scoring too little in the final 15 minutes of games was real. Every official match report from every match in the first 22 rounds in Besta deildin 2022 was analysed and the timing of each goal scored was recorded into an Excel document. The games were divided into six fifteen minute intervals. Minutes 1-15, 16-30, 31-45 (including first-half stoppage time), 46-60, 61-75, 76-90 (including second-half stoppage time), and each goal was placed in the appropriate column. This was done for each team individually. This procedure revealed that a far greater number of goals were scored in the final two 15-minute periods compared to the other four.

Table 1

Goal timing distribution for every team in the first 22 rounds of Besta Deildin 2022.

Minutes	**1-15.**	**16-30.**	**31-HT**	**46-60.**	**61-75.**	**76-FT**	**Total:**
Breiðablik	7-1.	7-3.	5-5.	10-4.	15-4.	11-6.	55-23
FH	4-6.	7-5.	3-7.	2-5.	2-5.	9-7.	27-35
Fram	6-9.	12-7.	4-6.	8-6.	11-8.	3-15.	44-51
Leiknir R.	4-7.	1-9.	3-8.	5-10.	4-10.	4-5.	21-49
ÍA	0-8.	2-9.	8-3.	4-8.	4-16.	6-9.	24-53
ÍBV	7-6.	8-9.	5-6.	4-6.	6-7.	3-10.	33-44
KA	2-3.	6-6.	6-4.	5-3.	6-6.	20-4.	45-26
KR	10-2.	6-4.	4-9.	7-7.	3-8.	7-4.	37-34
Keflavík	6-5.	5-8.	8-9.	5-3.	5-5.	10-10.	39-40
Stjarnan	7-6.	8-7.	7-11.	2-6.	10-6.	6-6.	40-42
Valur	1-3.	3-7.	11-1.	5-4.	13-7.	5-10.	38-32
Víkingur	6-3.	12-4.	10-5.	9-4.	11-8.	10-8.	58-32
Total:	60	77	74	66	90	94	461

Goals scored and conceded by each team, by every 15-minute period of matches in the first 22 rounds of Besta deildin 2022

Calculating expected values for Fram goals scored and conceded

The second step of the first part of this study was to calculate the expected goals to be scored and conceded by Fram in context with average goal timing distribution by other teams in the league.

The expected goals for Fram in every 15-minute period were calculated by multiplying the total number of goals scored by Fram in the first 22 rounds with the total number of goals scored in the league without Fram, divided by the number of goals scored without Fram in every 15-minute period. That method was repeated for each of the six 15-minute periods, and the same calculations were made with goals conceded.

These calculations aimed to establish a scaled value for goals, scored and conceded in every 15-minute period if the timing of their goals scored and conceded would have been in perfect correlation with the rest of the league.

The difference in observed goals scored and conceded by Fram was compared with the expected values using the Chi-Square test to determine whether the distribution was compatible.

Comparing performance in minutes 1-75 to 76- full time.

In the second part of this study, comparisons were made between a few selected frequency variables from minute 1 to 75 and minute 76 to the final whistle of the match. To make those comparisons relevant each variable for each part of the game had to be upscaled to 90 minutes.

Data sources

The selected variables for this study were goals, shots, and passes completed and attempted. The pass success rate was also calculated by dividing the number of attempted passes by number of completed passes.

Official stats from Besta deildin were used. Those reports included all of the selected frequency variables for this study, for the full match. Video recordings were used to count manually the selected frequency variables from the 76th minute onwards. The values of the selected frequency variables counted from the 76th minute onwards were deducted from the full-time values of the same variables in the official match report. To have the values for each variable in the two selected time frames separately.

Data analysis

To compare those unevenly long periods in the game, the values had to be upscaled to 90 minutes. Multiplying the values of the 75 minutes by 1,2 (75*1,2=90). And the 15 minutes were multiplied by 6 (15*6=90). This upscaling was not needed for percentage conversion variables, as they would, by the laws of math, stay the same.

All data was gathered in Excel. With the upscaled value for every variable for Fram and their opponents in the first 75 minutes and the last 15 minutes. The mean and standard deviation

were calculated for each variable. Then a paired t-test was conducted on each variable for Fram in the first 75 minutes and the 15 minutes, and the same was done with their opponent's stats.

Criteria for inclusion of available variables

The official stats in the match reports, provided by Besta deildin, included goals, expected goals (xG), possession, attempted passes, successful passes, pass success rate, shots, shots on goal, and shots outside the penalty box from the full 90 minutes of each match.

Possession, shots outside of the box, and xG were left out of the comparison for the reason of these variables being impossible to coordinate with the way they were made in the official stats. The impossibility is inherent in locating shots accurately with the view provided by the single camera recording to calculate xG and to determine whether a shot is taken from inside or outside the box. Possession would have to be more accurately defined to make it possible analyse in the last 15 minutes and coordinate with the official stats.

It's important to note that counting passes and shots can in some instances be a matter of interpretation, so there is a margin for expected inconsistency in the counting. Factors that can contribute to miscounting of passes and shots when manually notated can be human errors. Counting passes in real-time can be challenging, especially in a fast-paced match. For the observer distractions or visual occlusion can lead to pass being missed or misjudged. An error may occur in the subjectivity in defining a pass. Determining what counts as a pass can be subjective. Interpretations of what counts vary between observers when the ball's trajectory or intent is unclear. Some passes may be deflected or deviate from their intended path due to interceptions, deflections off players, or uneven playing surfaces. Identifying and correctly categorizing such passes can be challenging. The same thing goes for counting shots. The intent of the player involved may sometimes be unclear. In some situations, it might be hard to distinguish a shot from a cross for example. That can lead to inconsistency in the counting of those frequency variables.

Criteria for inclusion of matches

Matches that included red cards (1) were excluded from the data and matches where the required data from the official stats were incomplete (1). So, in total 20 matches were analysed in the second part of the study.

The decision to leave out matches that included red cards were made to avoid possible undue influence it might have on the comparison between the first 75 minutes and the last 15 minutes.

Results

The results of the Chi-Square goodness of fit test showed that the distribution of goals conceded by Fram was not significantly different from the rest of the league (p= 0.342), but goals scored by Fram were significantly differently distributed than the rest of the league (p= 0.044).

Table 2

Goal timing distribution. Fram in comparison to the rest of the league.

Minutes:	**1-15**	**16-30**	**31-HT**	**46-60**	**61-75**	**76-FT**	**Total**
Conceded: All matches, except for Fram matches	51	70	68	60	82	79	410
Scored: All matches, except for Fram matches	54	65	70	58	79	91	417
Fram conceded observed	9	7	6	6	8	15	51
Fram conceded expected	6.344	8.707	8.459	7.463	10.200	9.827	51
Fram scored observed	6	12	4	8	11	3	44
Fram scored expected	5.698	6.859	7.386	6.120	8.336	9.602	44

Table 2 *shows every goal scored per time 15-minute period in the first 22 rounds of Besta deildin 2022 excluding Fram matches. Then the goals Fram scored and conceded compared to Fram's expected goals, scored, and conceded if the goal distribution was the same as the rest of the league.*

Table 3

Difference in performance in first 75 minutes, compared to last 15 minutes.

Variable	Min 1-75	Min 76-FT	P (t-test)
Fram Passes Completed	398,2 ± 86,0	411,9 ± 105,3	0.556
Fram Pass Success Rate (%)	80,5 ± 6,9	74,1 ± 6,1	0.005*
Fram Total Shots	10,0 ± 4,2	13,5 ± 11,2	0.214
Fram Goals Scored	2,2 ± 1,4	0,9 ± 2,2	0.039*
Opposition Passes Completed	469,0 ± 115,4	476,1 ± 154,6	0.810
Opposition Pass Success Rate (%)	82,2 ± 5,9	76,6 ± 9,1	0.003*
Opposition Total Shots	14,9 ± 6,5	18,3 ± 12,1	0.247
Opposition Goals Scored	1,9 ± 1,8	4,2 ± 5,5	0.085

Table 3 shows performance in the first 75 minutes and the last 15 minutes each variable means and standard deviation, upscaled to 90 minutes.
*Significant difference.

Discussion

As expected, considering the goals scoring trends in most European football leagues a far greater number of goals were scored in the final 15 minutes than any other 15-minute period in the match for the first 22 rounds of Besta Deildin in 2022. Fram's contribution to that trend was mainly entailed in conceding those late goals rather than scoring them. Few of the possible contributing factors to the fact that most goals are scored at the end have already been mentioned. Mental fatigue leads to lapses in concentration (Sun et al., 2022), and physical fatigue leads to worse technical performance. Psychological factors, and of course the urgency felt by both teams to secure a favourable result as the match nears its end. Tactical tweaks are often made late in games, the winning team usually going more defensive as the trailing team goes for more attacking tactical changes, bringing in fresh substitutions of the bench to try to break up the game.

The results in Table 2 strongly suggest that a lack of goals scored by Fram in the final 15 minutes of a game is a bigger problem than the number of goals conceded by Fram in the same period. However, the result of the Chi-square test did determine that the overall probability of goals conceded by Fram was not significantly different from the rest of the league. Despite that, the table shows that the biggest difference in observed goals conceded (15) and the expected (9,827) is in the last 15 minutes. The 15 goals conceded by Fram in the final 15 minutes of games was the highest number of conceded goals in that period and the second highest was 10 goals.

The Chi-Square test determined a significant difference in the timing of goals scored by Fram compared to the rest of the league. The biggest contributing factors to that difference are the segments for minutes 16-30 where they scored 12 goals where the expected value was 6,859, and the final 15 minutes where the expected value was 9,602 goals, they only managed

to score 3 goals. 3 was the joint lowest value for goals scored by a team in the league in the last 15 minutes of a match.

As results show in Table 3 Fram Football Club has lower numbers than their opponents in all selected performance indicators. Even though the relative number of passes increases in the final 15 minutes, the pass success rate declines significantly for both Fram and their opponents. The number of shots increases in the last 15 minutes for both Fram and their opponents, but not significantly. As already established in Table 1, the goal-scoring drop by Fram in the final 15 minutes was significantly different from other teams. It was also significantly different from their own performance in the first 75 minutes of matches. And even though they concede most goals in the final 15 minutes, the difference was not significant compared to the other 75 minutes.

In 10 out of the 22 matches, Fram entered the final 15 minutes leading on the scoreboard. They only managed to secure the win in 5 games out of the 10. They lost one of the 10 matches, and drew in 4 of them, in two of those draws they were leading by 2 goals when entering the final 15 minutes of the match. Both those matches are against KA.

In 5 matches of the 22 the scoreline was even for Fram when entering the final 5 minutes. 4 of those matches ended in a draw, and 1 match was lost.

In 7 matches of the 22 Fram was trailing at the start of the final 15 minutes, in 2 matches they managed to secure a draw, but the other 5 games were lost.

For every win dropped to a draw two points are lost, for every win dropped to a loss three points are lost, for every draw dropped to a loss one point is lost. For every loss turned into a draw one point is gained. Using that logic Fram could have had 10 more points had the games ended after 75 minutes. That is more points lost in the final 15 minutes than any other team in the league. Those extra 10 points would have made an enormous difference in where they ended up in the league table.

KA was by far the most efficient team in the last 15 minutes of their games, scoring 20 goals in that period, while conceding only 4. Their performance in the final 15 minutes earned them extra 17 points.

Passes

Passes are a huge part of football. A study of the 2014 World Cup in Brazil found that there was a positive correlation between higher pass completion rates and match outcomes. The team with the higher pass completion rate was more likely to win. The study also found that the teams that played more possession-based football tended to perform better in the tournament (Król et al., 2017). The pass success rate can be expected to drop in the last 15 minutes of a game. The losing team is forced to take more risks and play more direct. While the winning team might use more long balls to relieve the pressure. Fram Football Club had fewer passes than their opponents in most games and there can be numerous explanations for that.

Fram had lower numbers of total passes than their opponents on average and a worse pass success rate. That is not necessarily a problem, despite some studies finding correlations between a higher number of passes to positive match outcomes (Król et al., 2017). The relevance of the total number of passes as a performance indicator is debatable. For more comprehensive analysis passes can be put into context with position, final third passes, forward passes, key passes, and passes between lines are all examples of categorisation of passes to add more value to the data.

The pass completion rate also needs to be put into context with the difficulty level of the passes and the team’s and player's style of play. The current method of grading passes is restricted to the binary labels 0 (unsuccessful) or 1 (successful) (Power et al., 2017).

A study examining the skill level of scouts, analysts, and coaches found that despite the increased interest in increased interest and the capability to measure contextual aspects of

passing performance with tracking technology, most practitioners still rely on more easily computed metrics like pass completion percentage (Herold et al., 2021).

Shots

The number of shots has been found to correlate positively with match outcomes. The higher number of shots leads to higher winning probabilities (Harrop & Nevill, 2014). The number of shots has been used for a long time in football analysis. But as anyone who has ever seen a game of football probably realises, is that not all shots have equal value.

Fram had fewer shots than their opponents on average in both the first 75 minutes and the last 15 minutes. But that information alone doesn't give a lot of insight into the attacking performance. Relatively recently a predictive model to evaluate every goal-scoring chance called Expected Goals (xG) was introduced in football. An xG model calculates the likelihood of scoring for each chance based on available information about the event-related variables. The xG value, ranging from 0 to 1, represents the probability of scoring, with higher values indicating a greater likelihood of scoring (*XG Stats Explained*, n.d.).

In practice, that means that a shot outside of the box might have a 5% chance of scoring, and a penalty 75% chance of scoring, which would add up to 0,8 xG. Values of xG are assigned based on models that assign probabilities to shots based on factors such as shot location, angle, distance, and other contextual variables. However, the specific models and their parameters can vary, leading to subjectivity in assigning probabilities to shots. Different xG models may produce slightly different values for the same shot (Orest, 2021). For that reason, xG was excluded from the study, as stated in the methods section. Even though xG cannot tell the full story of a game, it is a good way to add value to shot-related data in match analysis.

These results established that the performance from Fram in the last 15 minutes was worse than for other teams in the league concerning goals scored and conceded. But failed to

gain concrete evidence of what the cause might be. For future research, more factors need to be considered for more comprehensive results.

More factors to consider

Score line effect.

The impact of the scoreline is a very important variable in how the game progresses. In research from 2019 where the impact of the scoreline effect was investigated by considering important components that are usually omitted from scoreline effect studies, such as opposition ability, goal difference, and fatigue. The study found that the leading team tends to have more possession and play more defensively compared to the losing team. The study also found that the team behind on the scoresheet plays more offensively and takes more offensive actions such as shots, dribbles, and crosses. However, the team in the lead usually has a higher success rate of passes and shots indicating more passive and safe decisions in possession.

Overall, the study suggests that the scoreline effect plays a significant role in the playing style and performance in professional football (Redwood-Brown, 2019). In a recent study, Lago-Penas and Gomez-Lopez (2014) demonstrated that during elite English soccer matches, the percentages of ball possession, entries into the final one-third of the pitch, and shots on goal were lower for the teams with a 1 goal up game status compared to those with 1 goal down condition (Lago-Peñas & Gómez-López, 2014).

The most impressive aspect of Fram's performance in the 2022 season was their attacking play. They only failed to score in one game, that was against the team who became champions in that season. Coming into the last 15 minutes of the game with a lead, causes the team to be more passive, and perhaps to stop committing men forward, and try to hang on to the lead. But sometimes the best defence is a good offence.

Psychological momentum

The real and tangible phenomenon experienced by players that significantly impacts match outcomes. Psychological momentum can be positive or negative. Positive momentum is perceived by players as the feeling of confidence and control (Jones & Harwood, 2008). Positive momentum can be triggered by a lot of factors, such as scoreline, previous performances, crowd support, referee's decisions going your way, and so on. Those triggers lead to increased efforts and more motivation. While negative psychological momentum can be triggered by factors such as playing against opponents of higher ability, bad luck, conceding goals, pressure, fatigue, and many more. Those factors lead to reduced confidence, motivation, and effort (Jones & Harwood, 2008).

A lot of psychological factors may contribute to the problem of performance dropping late in the game. Losing points towards the end of the game can contribute to a negative psychological momentum.

Style of play

Style of play can also add valuable context to data. The style of play may prioritise keeping possession or playing direct, playing high press or low press. Playing save passes, or risky passes with possible high rewards.

Physiological factors.

It is natural to assume that when looking at the problem of underperforming in the last 15 minutes of a match that fatigue plays a part. Physical fatigue negatively affects a player's technical and physical abilities, like sprinting and jumping or performing an accurate pass or a good shot on goal (Dambroz et al., 2022). Some research also strongly suggests that physical fatigue may affect cognitive function (Abd-Elfattah et al., 2015). In fatigued football players, that may cause worse decision-making and so on. Tracking data and heart rate monitor data

that would have enabled physiological factors to be considered for this study were unfortunately not available.

Leonardo DaVinci said: “To develop a complete mind: Study the science of art; Study the art of science. Learn how to see. Realise that everything connects to everything else.” The first rule of ecology is that everything connects to everything else. A team performance is much like an ecological system, in the sense that a single performance indicator holds little informational value on its own, unless it can be put into context with everything else.

Conclusion

This study found that there was a significant difference in performance between Fram and the rest of the league, regarding goalscoring in the last 15 minutes of matches. However, the study failed to provide sufficient evidence of what the contributing factors might be. For future research, a broader view is recommended to consider more variables that can potentially be contributing factors to the problem.

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