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Investigating the Impact of the Mid-Season Winter Break on Technical Performance Levels across European Football – Does a Break in Play Affect Team Momentum?

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Investigating the Impact of the Mid-Season Winter Break on Technical Performance Levels across European Football Leagues – Does a Break in Play Affect Team Momentum?

Abstract

Using game-level data, this study examines what impact the mid-season winter break in football fixtures has on technical performance across European football leagues. 38 technical measures pertaining to the actions of passing and shooting are assessed for 3,494 team match observations from the German Bundesliga, Spanish La Liga, French Ligue 1 and English Premier League across 5 seasons from 2013/14 to 2017/18. Kruskal-Wallis One Way ANOVA's were conducted to investigate the differences between three groups: PREPRE (4-6 fixtures prior to the break); PRE (1-3 fixtures prior to the break); and POST (1-3 fixtures after the break). Shooting performance declined significantly post winter break in the German Bundesliga (13/21 metrics) which had an average break of 32 days. Passing performance deteriorated significantly in the French Ligue 1 (4/17 metrics) which had an average break of 19 days. The Spanish La Liga had a 13 day break on average and remained unaffected as did the English Premier League which had no mid-season winter break. Evidence suggests that a mid-season winter break of less than 13 days will not affect technical performance levels but breaks that last longer can act as a catalyst that halt momentum and cause performances to deteriorate.

Keywords: Soccer; Passing; Shooting; German Bundesliga; French Ligue 1; Spanish La Liga; English Premier League

Introduction

In recent years the field of performance analysis in football has been the focus of much research and interest in this field continues to grow (Lago, 2009; Mackenzie and Cushion, 2013). Much of this research has found that performance metrics pertaining to possession of the ball, successful passing and shooting are key determinants of success in football. Various aspects of possession and the passing attribute have been extensively reviewed such as, passing accuracy, passing range, longevity of passing sequences, and recovery of possession (Carmichael, Thomas and Ward, 2000; Jones, James and Mellalieu, 2004; Hughes and Churchill 2005; Lago-Penas, Lago-Ballesteros, Dellal and Gomez, 2010; Vogelbein, Nopp and Hökelmann 2014, Almeida, Ferreira and Volossovitch, 2014; Barreira, Garganta, Guimarães, MacHado and Anguera, 2014; Hughes and Lovell, 2019; Jamil, 2019). The importance of effective, accurate and frequent shooting has also been emphasised in previous research (Carmichael et al., 2000; Hughes and Churchill, 2005; Lago 2007; Carmichael and Thomas, 2008; Lago- Penas et al., 2010).

Something that has been generally overlooked is the potential impact of the mid-season winter break on these technical aspects of performance in football. Although there is some evidence to suggest a mid-season break is beneficial with regards to physical recuperation and injury prevention (Faude, Kellman, Ammann, Schnittker and Meyer, 2011; Funten, Faude, Lensch and Meyer, 2014; Ekstrand, Spreco and Davison, 2018), there is little evidence of the impact on technical aspects of team performances and in particular, team momentum built up throughout the early parts of the season.

As proposed by Vallerand, Colavecchio and Pelletier (1988) momentum begins with a catalyst, which is followed by a sequence of events that result in a change in performance. This definition is echoed by Taylor and Demick (1994) who explain momentum as a multidimensional construct in which a precipitating event will set off a chain of events, that

ultimately lead to an eventual change in performance. Momentum in sport is a concept that has been studied extensively and exists in two forms: behavioural and psychological (Mortimer and Burt, 2014). Behavioural momentum refers to observable actions that lead to measurable progress towards or away from a successful outcome (Wanzek, Houlihan and Homan, 2012). Psychological momentum, on the other hand, revolves around positive and negative perceptions of individual athletes or teams moving towards or away from a successful outcome (Cotterill, 2013).

Previous research has been conducted on both concepts of momentum with somewhat mixed results in team sports. In a study on hockey, Leard and Doyle (2011) discovered the existence of a momentum effect and concluded that a two-game or three-game winning streak would have a positive impact on the probability of winning. On the contrary, Kniffin and Mihalek (2014), discovered no evidence of any momentum effects in hockey and concluded that neither victory nor the margin of victory in a match had any bearing on the outcome of the next match. Arkes and Martinez (2011) investigated the existence of momentum in-between games in NBA basketball and concluded that success in the previous 3-5 matches led to an increased probability of winning the next match. Similarly, poor performances in previous matches led to a decreased chance of winning the next match. Morgulev, Azar and Bar-Eli (2018) also investigated momentum in NBA basketball and, contradictory to Arkes and Martinez (2011), they discovered no momentum effects.

Previous research has also focussed upon short term breaks in play acting as precipitating events that could potentially shift momentum. In the sport of volleyball, Wanzek et al. (2012) investigated whether a called timeout disrupted momentum but discovered that points scored post timeout were not affected. On the contrary, Gomez, Jimenez, Navarro, Lago-Penas and Sampaio (2011) discovered that both offensive and defensive performance levels enhanced post timeout in their study on basketball.

The purpose of this study is to examine momentum effects in football by examining the potential change in passing and shooting performances between three time periods (two before and one after the mid-season winter break). As stated by Mackenzie and Cushion (2013) and Mitrotasios, Gonzalez-Rodenas, Armatas and Aranda (2019), inter-league and inter-nation differences between technical performance levels have been relatively overlooked in previous research as well as several other aspects of match analysis. This particular concern will be addressed by this study as technical performance levels will be examined individually across several European football leagues, over a 5 season sample period, before and after their mid-season winter break thereby identifying the presence of any momentum effects.

The mid-season winter break will be treated as a long-term timeout and therefore, the model proposed by Taylor and Demick (1994) will be adapted by removing the psychological aspects leaving a three stage model akin to that utilised by Mortimer and Burt (2014). Our model therefore consists of three stages defined as a "trigger" followed by a "change in behaviour", followed by "the outcome". For the purposes of this study the "trigger" is defined as the start of the winter break. A mid-season winter break in football typically consists of several days away (usually unsupervised) followed by a return to training and build up to the first post winter break fixture. The lack of training whilst on break, the lack of supervision and the lack of competitive fixtures is therefore defined as the "change in behaviour" with "the outcome" being the subsequent change in performance upon the players' return post break, which is to be determined by the study.

Methods

Experimental Design

Throughout the five season sample period (2013/14 to 2017/18), the German Bundesliga, French Ligue 1 and Spanish La Liga all had mid-season winter breaks, unlike the English Premier League (EPL) which had no mid-season winter break allowing the latter to be

used for comparison. A dataset consisting of 38 technical performance metrics (tables 1.1 – 4.2) relating to the actions of passing and shooting from teams performing in these European Leagues was compiled in order to allow an investigation into the levels of performance 4-6 fixtures prior to the break (PREPRE); 1-3 fixtures prior to the break (PRE); and 1-3 fixtures after the break (POST).

Sample

Data sets were prepared which consisted of team match observations from the German Bundesliga (GB; n = 810), Spanish La Liga (SLL; n = 892) and French Ligue 1 (FL; n = 892). The samples each ranged across 5 seasons between 2013-14 and 2017/18. Three groups were formed: PREPRE; PRE; and POST. PREPRE consisted of 270 (GB), 300 (SLL) and 298 (FL) team, match observations, occurring between 4-6 gameweeks (match days) prior to the start of the winter break. PRE consisted of 268 (GB), 292 (SLL) and 296 (FL) team, match observations occurring 1-3 gameweeks prior to the start of the winter break. POST consisted of 272 (GB), 300 (SLL) and 298 (FL) team, match observations occurring 1-3 gameweeks after the end of the winter break.

The three groups were formed with the intention of including three fixtures for each team in each league, ensuring equally sized groups, however this was not possible due to some fixtures being postponed and fixture scheduling (some gameweeks consisting of less than the full quota of fixtures). The formation of equally sized groups was further complicated by the participation of German and Spanish teams in the FIFA Club World Cup championship (annually occurring in the second and third week of December) which subsequently caused some of the fixture rescheduling and postponements referred to above.

To further investigate what impact a mid-season winter break has on technical performance, each of the European leagues assessed above were compared to the English Premier League (EPL) (n = 900 team match observations), which during the same sample

period had no mid-season winter break. In order to ensure as much consistency as possible, 9 consecutive rounds of fixtures (gameweeks) were selected (in order: 3 representing PREPRE, 3 representing PRE and 3 representing POST). Each of the three groups, PREPRE, PRE and POST consisted of 300 fixtures. To ensure further consistency, these 9 selected gameweeks closely matched the same time period as the samples for the European leagues they were compared against (matches played from mid-November through to early January). Technical performance data utilised in this study was provided by OPTA sports, renowned for having a high degree of accuracy (Liu, Hopkins, Gómez and Molinuevo, 2013; Beato, Jamil and Devereux, 2018; Jamil, 2019). Tables 1.1 and 1.2 below present official OPTA definitions for each of the metrics utilised in this study.

*****Insert Tables 1.1 and 1.2 here*****

Statistical Analysis

Parametric assumption tests were conducted for each of the 38 technical measures analysed throughout this study and assumption violations were discovered meaning a non-parametric method was required. Consequently, Kruskal-Wallis One Way ANOVA tests were conducted to test for differences in means between PREPRE, PRE and POST for each of the 38 technical measures of performance analysed in this study. Post-hoc tests consisting of pairwise comparisons were also conducted in order to compare all different combinations of groups and identify differences in means between them. A 95% ($p < 0.05$) significance value was set initially, with significance values adjusted by the Bonferroni correction (Field 2014). Effect sizes, assessed as Pearson's r, were also calculated as they provide an objective measure of the magnitude of an effect (Field

2014). The widely used thresholds for *small* (0.1 – 0.3), *medium* (0.3 – 0.5) and *large* effects (> 0.5) set by Cohen (1992) were utilised in this study.

Results

Overall ANOVA results revealed significant effects for a total of thirteen technical measures (out of twenty one) pertaining to the action of shooting in German Bundesliga football (Table 1.3). Pairwise Comparisons (Table 1.3) revealed that eleven of these thirteen significant differences in means were associated with at least one of the two groups representing performance prior to the mid-season winter break (PREPRE and PRE) and the group representing performance after the break (POST). A closer analysis of the difference in means reveals that shooting accuracy and frequency deteriorates after the mid-season winter break. Metrics pertaining to the technical action of passing in the German Bundesliga were unaffected by the mid-season winter break (Table 1.4).

*****Insert Tables 1.3 and 1.4 here*****

Shooting was unaffected by the mid-season winter break in the French Ligue 1 (Table 2.1), however metrics pertaining to the technical action of passing revealed significant differences in means between PRE and POST break performance (Table 2.2). Four out of seventeen measures pertaining to the technical action of passing were revealed to be significant (initially 6 measures prior to Bonferroni correction). Similarly to the Bundesliga shooting results, pairwise comparisons of mean differences between groups in the French Ligue 1, revealed that passing performance deteriorated after the mid-season winter break. All significant differences discovered in the German Bundesliga and French Ligue 1 were revealed to have small effect sizes however this is to be expected due to the multifaceted nature of

football where a combination of variables contribute to overall performance (Mackenzie and Cushion, 2013).

*****Insert Tables 2.1 and 2.2 here*****

No significant differences in means for either shooting or passing were discovered in the Spanish La Liga (Tables 3.1 and 3.2). Similarly, no significant differences in means for either shooting or passing were discovered in the English Premier League (Tables 4.1 and 4.2).

*****Insert Tables 3.1, 3.2, 4.1 and 4.2 here*****

Discussion

The results reveal that the technical performance levels of professional football players deteriorates post mid-season winter break but only in the German Bundesliga and the French Ligue 1. The Spanish La Liga remains unaffected by the mid-season winter break. Throughout the sample period, the average length in number of days for the winter break in the German Bundesliga was 32 days (between the last fixture in the PRE phase and the first fixture in the POST phase). In the French League 1, the length of the winter break averaged 18.6 days, whereas the break only lasted 12.2 days on average in the Spanish La Liga.

The results obtained suggest that in cases where the mid-season winter break lasts longer than 13 days, the start of the break acts as a trigger that disrupts momentum by leading to a change in behaviour, causing an ultimate change in performance. Specifically, the change in performance precipitated by the mid-season winter break is a deterioration of shooting frequency and accuracy in the German Bundesliga and passing frequency and accuracy in the French Ligue 1. Furthermore, this deterioration of shooting frequency and accuracy in the German Bundesliga and passing frequency and accuracy in the French Ligue 1 both occur in

attacking areas of the playing field implying that attacking fluency is most affected by the winter breaks in these countries.

The lack of significant changes in means discovered from a parallel analysis conducted on the English Premier League that has no mid-season winter break further reinforces the notion that the winter break, particularly if greater in length than 13 days, disrupts performances and leads to an eventual decline in technical performance levels upon players return post break.

A closer look at the pairwise comparisons results reveals that almost all significant differences in means were discovered between the PREPRE - POST phase and/or the PRE - POST phase or both. Pairwise comparisons revealed that there were only a minority of significant differences in means between the PREPRE and PRE phases (which both occur prior to the mid-season winter break), lending further support to the argument that the mid-season winter break acts as a catalyst/precipitating event and is partly responsible for the decline in technical performance levels discovered in this study in the top divisions of both, German and French football.

The fact that performance deteriorates during the POST phase after the winter break could be explained by a number of reasons, such as a lack of training, an unfavourable diet or a lack of physical conditioning post winter break. In a study on Rugby players, Jensen, Gleason and VanNess (2018) discovered that a winter break of greater than 4 weeks resulted in a change in some of the players physical shape. Specifically, Jensen et al. (2018) discovered that the body mass of players increased largely due to an increase in body fat percentage. Jensen et al. (2018) concluded that although rugby players do not necessarily need to be prescribed exercise routines during the mid-season break they would benefit from some structured nutritional advice. Furthermore, In a study on women's hockey Jones and McGregor (2010) discovered that general fitness levels dipped after their midseason Christmas break, which the authors

attributed to poor weather prohibiting athletes from exercising/training and potentially the athletes' poor adherence to their personal training regimes. In a study on English Premiership Academy teams, Moore, Cloke, Avery, Beasley and Deehan (2011) discovered that the peak injury period for academy players was post mid-season winter break which the authors attributed to a lack of adequate physical conditioning when players returned from the break.

From a practical perspective the results obtained in this study offer some insight to the governing bodies of German and French football (DFB and FFF) with regards to the quality of football played post winter break and they could explore shortening their mid-season winter breaks in order to enhance this quality (weather and broadcasting contracts permitting). These results also offer some guidance to the governing bodies of other nations around the world that are yet to formally introduce a mid-season winter break, to ensure their break is less than 13 days in length. From a coaching perspective, the results obtained in this study highlight the lack of player sharpness when returning post break in Germany and France, suggesting the need for greater supervision during the break and perhaps more intensive training and conditioning prior to the first few fixtures played post break.

Previous studies have revealed physical benefits of a mid-season winter break thus future studies should focus on whether the deterioration in technical performance and the subsequent loss of momentum caused by these mid-season winter breaks is offset by their previously proven physical benefits. Future studies could also investigate the optimal balance between ensuring high levels of technical performance whilst also receiving physical benefits of mid-season winter breaks. Furthermore, this study revealed shooting performance deteriorates in the German Bundesliga and passing performance deteriorates in the French Ligue 1. It is beyond the scope of this present study to ascertain why one technical action was affected and not the other in each nation, however this could be investigated in follow-up studies.

Conclusion

The results obtained from this study revealed that technical performance levels of professional football players performing in the German Bundesliga and French Ligue 1 are negatively affected by the mid-season winter break. Specifically, the frequency and accuracy of crucial actions such as shooting and passing are significantly affected by the mid-season winter break. The results of this study also suggest that the longer this mid-season winter break the greater the level of deterioration in technical performance levels. More specifically, if a mid-season winter break is longer in duration than 13 days, then it appears to act as a catalyst/precipitating event which ultimately contribute towards negative momentum effects in European football.

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Previous research has also focussed upon short term breaks in play acting as precipitating events that could potentially shift momentum. In the sport of volleyball, Wanzek et al. (2012) investigated whether a called timeout disrupted momentum but discovered that points scored post timeout were not affected. On the contrary, Gomez, Jimenez, Navarro, Lago-Penas and Sampaio (2011) discovered that both offensive and defensive performance levels enhanced post timeout in their study on basketball.

The purpose of this study is to examine momentum effects in football by examining the potential change in passing and shooting performances between three time periods (two before and one after the mid-season winter break). As stated by Mackenzie and Cushion (2013) and Mitrotasios, Gonzalez-Rodenas, Armatas and Aranda (2019), inter-league and inter-nation differences between technical performance levels have been relatively overlooked in previous research as well as several other aspects of match analysis. This particular concern will be addressed by this study as technical performance levels will be examined individually across several European football leagues, over a 5 season sample period, before and after their mid-season winter break thereby identifying the presence of any momentum effects.

The mid-season winter break will be treated as a long-term timeout and therefore, the model proposed by Taylor and Demick (1994) will be adapted by removing the psychological aspects leaving a three stage model akin to that utilised by Mortimer and Burt (2014). Our model therefore consists of three stages defined as a "trigger" followed by a "change in behaviour", followed by "the outcome". For the purposes of this study the "trigger" is defined as the start of the winter break. A mid-season winter break in football typically consists of several days away (usually unsupervised) followed by a return to training and build up to the first post winter break fixture. The lack of training whilst on break, the lack of supervision and the lack of competitive fixtures is therefore defined as the "change in behaviour" with "the outcome" being the subsequent change in performance upon the players' return post break, which is to be determined by the study.

Methods

Experimental Design

Throughout the five season sample period (2013/14 to 2017/18), the German Bundesliga, French Ligue 1 and Spanish La Liga all had mid-season winter breaks, unlike the English Premier League (EPL) which had no mid-season winter break allowing the latter to be

used for comparison. A dataset consisting of 38 technical performance metrics (tables 1.1 – 4.2) relating to the actions of passing and shooting from teams performing in these European Leagues was compiled in order to allow an investigation into the levels of performance 4-6 fixtures prior to the break (PREPRE); 1-3 fixtures prior to the break (PRE); and 1-3 fixtures after the break (POST).

Sample

Data sets were prepared which consisted of team match observations from the German Bundesliga (GB; n = 810), Spanish La Liga (SLL; n = 892) and French Ligue 1 (FL; n = 892). The samples each ranged across 5 seasons between 2013-14 and 2017/18. Three groups were formed: PREPRE; PRE; and POST. PREPRE consisted of 270 (GB), 300 (SLL) and 298 (FL) team, match observations, occurring between 4-6 gameweeks (match days) prior to the start of the winter break. PRE consisted of 268 (GB), 292 (SLL) and 296 (FL) team, match observations occurring 1-3 gameweeks prior to the start of the winter break. POST consisted of 272 (GB), 300 (SLL) and 298 (FL) team, match observations occurring 1-3 gameweeks after the end of the winter break.

The three groups were formed with the intention of including three fixtures for each team in each league, ensuring equally sized groups, however this was not possible due to some fixtures being postponed and fixture scheduling (some gameweeks consisting of less than the full quota of fixtures). The formation of equally sized groups was further complicated by the participation of German and Spanish teams in the FIFA Club World Cup championship (annually occurring in the second and third week of December) which subsequently caused some of the fixture rescheduling and postponements referred to above.

To further investigate what impact a mid-season winter break has on technical performance, each of the European leagues assessed above were compared to the English Premier League (EPL) (n = 900 team match observations), which during the same sample

period had no mid-season winter break. In order to ensure as much consistency as possible, 9 consecutive rounds of fixtures (gameweeks) were selected (in order: 3 representing PREPRE, 3 representing PRE and 3 representing POST). Each of the three groups, PREPRE, PRE and POST consisted of 300 fixtures. To ensure further consistency, these 9 selected gameweeks closely matched the same time period as the samples for the European leagues they were compared against (matches played from mid-November through to early January). Technical performance data utilised in this study was provided by OPTA sports, renowned for having a high degree of accuracy (Liu, Hopkins, Gómez and Molinuevo, 2013; Beato, Jamil and Devereux, 2018; Jamil, 2019). Tables 1.1 and 1.2 below present official OPTA definitions for each of the metrics utilised in this study.

*****Insert Tables 1.1 and 1.2 here*****

Statistical Analysis

Parametric assumption tests were conducted for each of the 38 technical measures analysed throughout this study and assumption violations were discovered meaning a non-parametric method was required. Consequently, Kruskal-Wallis One Way ANOVA tests were conducted to test for differences in means between PREPRE, PRE and POST for each of the 38 technical measures of performance analysed in this study. Post-hoc tests consisting of pairwise comparisons were also conducted in order to compare all different combinations of groups and identify differences in means between them. A 95% ($p < 0.05$) significance value was set initially, with significance values adjusted by the Bonferroni correction (Field 2014). Effect sizes, assessed as Pearson's r, were also calculated as they provide an objective measure of the magnitude of an effect (Field

2014). The widely used thresholds for *small* (0.1 – 0.3), *medium* (0.3 – 0.5) and *large* effects (> 0.5) set by Cohen (1992) were utilised in this study.

Results

Overall ANOVA results revealed significant effects for a total of thirteen technical measures (out of twenty one) pertaining to the action of shooting in German Bundesliga football (Table 1.3). Pairwise Comparisons (Table 1.3) revealed that eleven of these thirteen significant differences in means were associated with at least one of the two groups representing performance prior to the mid-season winter break (PREPRE and PRE) and the group representing performance after the break (POST). A closer analysis of the difference in means reveals that shooting accuracy and frequency deteriorates after the mid-season winter break. Metrics pertaining to the technical action of passing in the German Bundesliga were unaffected by the mid-season winter break (Table 1.4).

*****Insert Tables 1.3 and 1.4 here*****

Shooting was unaffected by the mid-season winter break in the French Ligue 1 (Table 2.1), however metrics pertaining to the technical action of passing revealed significant differences in means between PRE and POST break performance (Table 2.2). Four out of seventeen measures pertaining to the technical action of passing were revealed to be significant (initially 6 measures prior to Bonferroni correction). Similarly to the Bundesliga shooting results, pairwise comparisons of mean differences between groups in the French Ligue 1, revealed that passing performance deteriorated after the mid-season winter break. All significant differences discovered in the German Bundesliga and French Ligue 1 were revealed to have small effect sizes however this is to be expected due to the multifaceted nature of

175 football where a combination of variables contribute to overall performance (Mackenzie and
176 Cushion, 2013).
177
178 ***Insert Tables 2.1 and 2.2 here***
179
180 No significant differences in means for either shooting or passing were discovered in
181 the Spanish La Liga (Tables 3.1 and 3.2). Similarly, no significant differences in means for
182 either shooting or passing were discovered in the English Premier League (Tables 4.1 and 4.2).
183
184 ***Insert Tables 3.1, 3.2, 4.1 and 4.2 here***

185 **Discussion**

186 The results reveal that the technical performance levels of professional football players
187 deteriorates post mid-season winter break but only in the German Bundesliga and the French
188 Ligue 1. The Spanish La Liga remains unaffected by the mid-season winter break. Throughout
189 the sample period, the average length in number of days for the winter break in the German
190 Bundesliga was 32 days (between the last fixture in the PRE phase and the first fixture in the
191 POST phase). In the French League 1, the length of the winter break averaged 18.6 days,
192 whereas the break only lasted 12.2 days on average in the Spanish La Liga.
193 The results obtained suggest that in cases where the mid-season winter break lasts
194 longer than 13 days, the start of the break acts as a trigger that disrupts momentum by leading
195 to a change in behaviour, causing an ultimate change in performance. Specifically, the change
196 in performance precipitated by the mid-season winter break is a deterioration of shooting
197 frequency and accuracy in the German Bundesliga and passing frequency and accuracy in the
198 French Ligue 1. Furthermore, this deterioration of shooting frequency and accuracy in the
199 German Bundesliga and passing frequency and accuracy in the French Ligue 1 both occur in

attacking areas of the playing field implying that attacking fluency is most affected by the winter breaks in these countries.

The lack of significant changes in means discovered from a parallel analysis conducted on the English Premier League that has no mid-season winter break further reinforces the notion that the winter break, particularly if greater in length than 13 days, disrupts performances and leads to an eventual decline in technical performance levels upon players return post break.

A closer look at the pairwise comparisons results reveals that almost all significant differences in means were discovered between the PREPRE - POST phase and/or the PRE - POST phase or both. Pairwise comparisons revealed that there were only a minority of significant differences in means between the PREPRE and PRE phases (which both occur prior to the mid-season winter break), lending further support to the argument that the mid-season winter break acts as a catalyst/precipitating event and is partly responsible for the decline in technical performance levels discovered in this study in the top divisions of both, German and French football.

The fact that performance deteriorates during the POST phase after the winter break could be explained by a number of reasons, such as a lack of training, an unfavourable diet or a lack of physical conditioning post winter break. In a study on Rugby players, Jensen, Gleason and VanNess (2018) discovered that a winter break of greater than 4 weeks resulted in a change in some of the players physical shape. Specifically, Jensen et al. (2018) discovered that the body mass of players increased largely due to an increase in body fat percentage. Jensen et al. (2018) concluded that although rugby players do not necessarily need to be prescribed exercise routines during the mid-season break they would benefit from some structured nutritional advice. Furthermore, In a study on women's hockey Jones and McGregor (2010) discovered that general fitness levels dipped after their midseason Christmas break, which the authors

attributed to poor weather prohibiting athletes from exercising/training and potentially the athletes' poor adherence to their personal training regimes. In a study on English Premiership Academy teams, Moore, Cloke, Avery, Beasley and Deehan (2011) discovered that the peak injury period for academy players was post mid-season winter break which the authors attributed to a lack of adequate physical conditioning when players returned from the break.

From a practical perspective the results obtained in this study offer some insight to the governing bodies of German and French football (DFB and FFF) with regards to the quality of football played post winter break and they could explore shortening their mid-season winter breaks in order to enhance this quality (weather and broadcasting contracts permitting). These results also offer some guidance to the governing bodies of other nations around the world that are yet to formally introduce a mid-season winter break, to ensure their break is less than 13 days in length. From a coaching perspective, the results obtained in this study highlight the lack of player sharpness when returning post break in Germany and France, suggesting the need for greater supervision during the break and perhaps more intensive training and conditioning prior to the first few fixtures played post break.

Previous studies have revealed physical benefits of a mid-season winter break thus future studies should focus on whether the deterioration in technical performance and the subsequent loss of momentum caused by these mid-season winter breaks is offset by their previously proven physical benefits. Future studies could also investigate the optimal balance between ensuring high levels of technical performance whilst also receiving physical benefits of mid-season winter breaks. Furthermore, this study revealed shooting performance deteriorates in the German Bundesliga and passing performance deteriorates in the French Ligue 1. It is beyond the scope of this present study to ascertain why one technical action was affected and not the other in each nation, however this could be investigated in follow-up studies.

Conclusion

The results obtained from this study revealed that technical performance levels of professional football players performing in the German Bundesliga and French Ligue 1 are negatively affected by the mid-season winter break. Specifically, the frequency and accuracy of crucial actions such as shooting and passing are significantly affected by the mid-season winter break. The results of this study also suggest that the longer this mid-season winter break the greater the level of deterioration in technical performance levels. More specifically, if a mid-season winter break is longer in duration than 13 days, then it appears to act as a catalyst/precipitating event which ultimately contribute towards negative momentum effects in European football.

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Table 1.1 – Variable Definitions List for Shooting Metrics

(1) Shots on target including goals	Any goal or goal attempt that: - Goes into the net regardless of intent. - Is a clear attempt to score that would have gone into the net but for being saved by the goalkeeper or is stopped by a player who is the last-man with the goalkeeper having no chance of preventing the goal (last line block).
(2) Shots off target including woodwork	Any clear attempt to score that: - Goes over or wide of the goal without making contact with another player. - Would have gone over or wide of the goal but for being stopped by a goalkeeper's save or by an outfield player. - Directly hits the frame of the goal and a goal is not scored.
(3) Direct free Kick on target	Direct free kick shots created directly from the free kick itself (unassisted) and (1)
(4) Direct free Kick off target	Direct free kick shots created directly from the free kick itself (unassisted) and (2)
(5) Shots on From Inside Box	(1) from inside the 18-yard box
(6) Shots off From Inside Box	(2) from outside the 18-yard box
(7) Goals from inside box	Number of goals scored from inside the 18-yard box
(8) Goals from outside box	Number of goals scored from outside the 18-yard box
(9) Shots on Target Outside Box	(1) from outside the 18-yard box
(10) Right foot shots on target	(1) attempted with the right foot
(11) Left foot shots on target	(1) attempted with the left foot
(12) Goals conceded inside box	Number of goals conceded from inside the 18-yard box
(13) Goals conceded outside box	Number of goals conceded from outside the 18-yard box
(14) Shots on conceded	Number of shots on target (1) conceded
(15) Shots on conceded inside box	Number of shots on target (1) conceded from inside the 18-yard box
(16) Shots on conceded outside box	Number of shots on target (1) conceded from outside the 18-yard box
(17) Total Shots Conceded	Total number of shots (1) and (2) conceded
(18) Right Foot Shots	Total number of shots attempted with the right foot
(19) Left Foot Shots	Total number of shots attempted with the left foot
(20) Shooting accuracy right foot	A calculation of shots on target divided by all shots (excluding blocked attempts and own goals) (right foot only)
(21) Shooting accuracy left foot	A calculation of shots on target divided by all shots (excluding blocked attempts and own goals) (left foot only)

Table 1.2 – Variable Definitions List for Passing Metrics

(1) Total successful passes excluding crosses and corners	Any intentional played ball from one player to another (successfully received by the intended recipient without a touch from an opposing player). Passes include open play passes, goal kicks and free kicks played as a pass.
(2) Total unsuccessful passes excluding crosses and corners	Any intentional played ball from one player to another (unsuccessfully received by the intended recipient). Passes include open play passes, goal kicks and free kicks played as a pass.
(3) Successful passes own half	(1) played in a subject team's own half
(4) Unsuccessful passes own half	(2) played in a subject team's own half
(5) Successful passes opposition half	(1) played in an opposing team's half
(6) Unsuccessful passes opposition half	(2) played in an opposing team's half
(7) Successful passes defensive third	(1) played in a subject team's defensive third
(8) Unsuccessful passes defensive third	(2) played in a subject team's defensive third
(9) Successful passes middle third	(1) played in a subject team's middle third
(10) Unsuccessful passes middle third	(2) played in a subject team's middle third
(11) Successful passes final third	(1) played in a subject team's final third
(12) Unsuccessful passes final third	(2) played in a subject team's final third
(13) Successful short passes	(1) under 32 metres in distance
(14) Unsuccessful short passes	(2) under 32 metres in distance
(15) Successful long passes	(1) over 32 metres in distance
(16) Unsuccessful long passes	(2) over 32 metres in distance
(17) Through Ball	Ball played through for player making an attacking run to create a chance on goal

Table 1.3 – Technical measures pertaining to shooting assessed in the German Bundesliga

Technical Measure	H	P - value	Pairwise difference	Mean Analysis	P – value	Effect Size (r)
				Direction (Mean Rank Values)	(post-hoc)	
Shots on target including goals	12.368	0.002**	PREPRE – POST	Decrease post break (437 – 368)	0.002**	0.149
Shots off target including woodwork	1.699	0.428+	-	-	-	-
Direct free Kick on target	5.517	0.063+	-	-	-	-
Direct free Kick off target	9.375	0.009**	PREPRE – POST	Decrease post break (427 – 383)	0.007**	0.132
Shots on From Inside Box	9.650	0.008**	PREPRE - POST	Decrease post break (423 – 370)	0.023*	0.115
			PRE - POST	Decrease post break (424 – 370)	0.021*	0.116
Shots off From Inside Box	0.761	0.684+	-	-	-	-
Goals from inside box	3.396	0.183+	-	-	-	-
Goals from outside box	6.482	0.039*	PREPRE - PRE	Decrease pre break (423 – 390)	0.034*	0.109
Shots on Target Outside Box	8.011	0.018*	PREPRE - PRE	Decrease pre break (437 – 389)	0.038*	0.108
			PREPRE - POST	Decrease post break (437 – 391)	0.048*	0.103
Right foot shots on target	7.997	0.018*	PREPRE - POST	Decrease post break (431 – 375)	0.016*	0.12
Left foot shots on target	5.982	0.05+	-	-	-	-
Goals conceded inside box	3.396	0.183+	-	-	-	-
Goals conceded outside box	6.482	0.039*	PREPRE – PRE	Decrease post break (423 – 390)	0.034*	0.109
Shots on conceded	12.724	0.002**	PREPRE – POST	Decrease post break (438 – 367)	0.001**	0.152
Shots on conceded inside box	9.671	0.008**	PREPRE – POST	Decrease post break (424 – 370)	0.019*	0.118
			PRE - POST	Decrease post break (423 – 370)	0.025*	0.114
Shots on conceded outside box	8.011	0.018*	PREPRE - PRE	Decrease post break (437 – 389)	0.038*	0.108
			PREPRE - POST	Decrease post break (437 – 391)	0.048*	0.103
Total Shots Conceded	9.482	0.009**	PREPRE – POST	Decrease post break (436 – 375)	0.006**	0.132
Right Foot Shots	3.089	0.213+	-	-	-	-
Left Foot Shots	12.622	0.002**	PREPRE – POST	Decrease post break (442 – 371)	0.001**	0.152
Shooting accuracy right foot	7.895	0.019*	PREPRE – POST	Decrease post break (428 – 374)	0.021*	0.116
Shooting accuracy left foot	0.485	0.785+	-	-	-	-

PREPRE = 4-6 fixtures prior to the winter break, PRE = 1-3 fixtures prior to the winter break, POST = 1-3 fixtures after the winter break
** = Significant at 99% CI, * = Significant at 95% CI, + = Insignificant
Mean rank figures are displayed to nearest whole number

Table 1.4 – Technical measures pertaining to passing assessed in the German Bundesliga

Technical Measure	H	P - value	Pairwise difference	Mean Analysis Direction (Mean Rank Values)	P – value (post-hoc)	Effect Size (r)
Total successful passes excl crosses and corners	0.368	0.832+	-	-	-	-
Total unsuccessful passes excl crosses and corners	3.441	0.179+	-	-	-	-
Successful passes own half	0.936	0.626+	-	-	-	-
Unsuccessful passes own half	0.818	0.664+	-	-	-	-
Successful passes opposition half	0.504	0.777+	-	-	-	-
Unsuccessful passes opposition half	5.864	0.053+	-	-	-	-
Successful passes defensive third	2.390	0.303+	-	-	-	-
Unsuccessful passes defensive third	2.826	0.243+	-	-	-	-
Successful passes middle third	0.643	0.725+	-	-	-	-
Unsuccessful passes middle third	1.831	0.400+	-	-	-	-
Successful passes final third	0.404	0.817+	-	-	-	-
Unsuccessful passes final third	3.018	0.221+	-	-	-	-
Successful short passes	0.440	0.817+	-	-	-	-
Unsuccessful short passes	2.667	0.264+	-	-	-	-
Successful long passes	3.167	0.205+	-	-	-	-
Unsuccessful long passes	2.407	0.300+	-	-	-	-
Through Ball	4.272	0.118+	-	-	-	-

PREPRE = 4-6 fixtures prior to the winter break, PRE = 1-3 fixtures prior to the winter break, POST = 1-3 fixtures after the winter break
** = Significant at 99% CI, * = Significant at 95% CI, + = Insignificant

Table 2.1 – Technical measures pertaining to shooting assessed in the French Ligue 1

Technical Measure	H	P - value	Pairwise difference	Mean Analysis Direction (Mean Rank Values)	P – value (post-hoc)	Effect Size (r)
Shots on target including goals	0.858	0.651+	-	-	-	-
Shots off target including woodwork	0.418	0.812+	-	-	-	-
Direct free Kick on target	0.471	0.790+	-	-	-	-
Direct free Kick off target	1.455	0.483+	-	-	-	-
Shots on From Inside Box	0.221	0.895+	-	-	-	-
Shots off From Inside Box	1.253	0.534+	-	-	-	-
Goals from inside box	1.844	0.398+	-	-	-	-
Goals from outside box	1.744	0.418+	-	-	-	-
Shots on Target Outside Box	2.608	0.272+	-	-	-	-
Right foot shots on target	0.521	0.771+	-	-	-	-
Left foot shots on target	1.211	0.546+	-	-	-	-
Goals conceded inside box	1.844	0.398+	-	-	-	-
Goals conceded outside box	1.744	0.418+	-	-	-	-
Shots on conceded	0.588	0.745+	-	-	-	-
Shots on conceded inside box	0.070	0.965+	-	-	-	-
Shots on conceded outside box	2.608	0.272+	-	-	-	-
Total Shots Conceded	0.992	0.609+	-	-	-	-
Right Foot Shots	0.230	0.892+	-	-	-	-
Left Foot Shots	4.735	0.094+	-	-	-	-
Shooting accuracy right foot	1.679	0.432+	-	-	-	-
Shooting accuracy left foot	1.729	0.421+	-	-	-	-

PREPRE = 4-6 fixtures prior to the winter break, PRE = 1-3 fixtures prior to the winter break, POST = 1-3 fixtures after the winter break
** = Significant at 99% CI, * = Significant at 95% CI, + = Insignificant

Table 2.2 – Technical measures pertaining to passing assessed in the French Ligue 1

Technical Measure	H	P - value	Pairwise difference	Mean Analysis Direction (Mean Rank Values)	P – value (post-hoc)	Effect Size (r)
Total successful passes excl crosses and corners	0.484	0.785	-	-	-	-
Total unsuccessful passes excl crosses and corners	7.711	0.021*	PRE – POST	Increase post break (415 – 473)	0.018*	0.113
Successful passes own half	0.963	0.618+	-	-	-	-
Unsuccessful passes own half	6.386	0.041*	PRE - POST	Increase post break (429 – 477)	0.069+	-
Successful passes opposition half	0.391	0.822+	-	-	-	-
Unsuccessful passes opposition half	6.901	0.032*	PRE – POST	Increase post break (415 – 469)	0.034*	0.104
Successful passes defensive third	1.826	0.401+	-	-	-	-
Unsuccessful passes defensive third	5.179	0.075+	-	-	-	-
Successful passes middle third	0.609	0.737+	-	-	-	-
Unsuccessful passes middle third	6.985	0.030*	PRE– POST	Increase post break (419 – 475)	0.025*	0.108
Successful passes final third	0.944	0.624+	-	-	-	-
Unsuccessful passes final third	1.502	0.472+	-	-	-	-
Successful short passes	0.506	0.777+				
Unsuccessful short passes	10.902	0.004**	PRE – POST	Increase post break (410 – 480)	0.003**	0.136
Successful long passes	1.097	0.578+	-	-	-	-
Unsuccessful long passes	0.987	0.611+	-	-	-	-
Through Ball	6.177	0.046*	PREPRE – POST	Decrease post break (462 – 421)	0.067+	-

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** = Significant at 99% CI, * = Significant at 95% CI, + = Insignificant
Mean rank figures are displayed to nearest whole number

Table 3.1 – Technical measures pertaining to shooting assessed in the Spanish La Liga

Technical Measure	H	P - value	Pairwise difference	Mean Analysis Direction (Mean Rank Values)	P – value (post-hoc)	Effect Size (r)
Shots on target including goals	5.211	0.074+	-	-	-	-
Shots off target including woodwork	0.402	0.818+	-	-	-	-
Direct free Kick on target	2.441	0.295+	-	-	-	-
Direct free Kick off target	4.453	0.108+	-	-	-	-
Shots on From Inside Box	3.537	0.171+	-	-	-	-
Shots off From Inside Box	0.804	0.669+	-	-	-	-
Goals from inside box	0.588	0.745+	-	-	-	-
Goals from outside box	0.874	0.646+	-	-	-	-
Shots on Target Outside Box	2.146	0.342+	-	-	-	-
Right foot shots on target	6.792	0.034*	PREPRE - PRE	Decrease pre break (463 – 415)	0.065+	-
Left foot shots on target	3.344	0.188+	-	-	-	-
Goals conceded inside box	0.722	0.697+	-	-	-	-
Goals conceded outside box	0.464	0.793+	-	-	-	-
Shots on conceded	5.400	0.067+	-	-	-	-
Shots on conceded inside box	3.711	0.156+	-	-	-	-
Shots on conceded outside box	2.146	0.342+	-	-	-	-
Total Shots Conceded	0.735	0.693+	-	-	-	-
Right Foot Shots	0.456	0.796+	-	-	-	-
Left Foot Shots	0.847	0.655+	-	-	-	-
Shooting accuracy right foot	3.973	0.137+	-	-	-	-
Shooting accuracy left foot	1.856	0.395+	-	-	-	-

PREPRE = 4-6 fixtures prior to the winter break, PRE = 1-3 fixtures prior to the winter break, POST = 1-3 fixtures after the winter break
** = Significant at 99% CI, * = Significant at 95% CI, + = Insignificant
Mean rank figures are displayed to nearest whole number

Table 3.2 – Technical measures pertaining to passing assessed in the Spanish La Liga

Technical Measure	H	P - value	Pairwise difference	Mean Analysis Direction (Mean Rank Values)	P – value (post-hoc)	Effect Size (r)
Total successful passes excl crosses and corners	0.664	0.717+	-	-	-	-
Total unsuccessful passes excl crosses and corners	0.061	0.970+	-	-	-	-
Successful passes own half	1.552	0.460+	-	-	-	-
Unsuccessful passes own half	4.191	0.123+	-	-	-	-
Successful passes opposition half	0.394	0.821+	-	-	-	-
Unsuccessful passes opposition half	0.491	0.782+	-	-	-	-
Successful passes defensive third	1.576	0.455+	-	-	-	-
Unsuccessful passes defensive third	5.721	0.057+	-	-	-	-
Successful passes middle third	0.571	0.751+	-	-	-	-
Unsuccessful passes middle third	0.005	0.998+	-	-	-	-
Successful passes final third	1.555	0.460+	-	-	-	-
Unsuccessful passes final third	0.070	0.966+	-	-	-	-
Successful short passes	0.810	0.667+	-	-	-	-
Unsuccessful short passes	0.816	0.665+	-	-	-	-
Successful long passes	0.943	0.624+	-	-	-	-
Unsuccessful long passes	0.163	0.922+	-	-	-	-
Through Ball	0.729	0.695+	-	-	-	-

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Table 4.1 – Technical measures pertaining to shooting assessed in the English Premier League

Technical Measure	H	P - value	Pairwise difference	Mean Analysis Direction (Mean Rank Values)	P – value (post-hoc)	Effect Size (r)
Shots on target including goals	0.249	0.883+	-	-	-	-
Shots off target including woodwork	2.137	0.343+	-	-	-	-
Direct free Kick on target	0.904	0.636+	-	-	-	-
Direct free Kick off target	1.427	0.477+	-	-	-	-
Shots on From Inside Box	1.233	0.540+	-	-	-	-
Shots off From Inside Box	2.111	0.348+	-	-	-	-
Goals from inside box	0.447	0.800+	-	-	-	-
Goals from outside box	0.755	0.686+	-	-	-	-
Shots on Target Outside Box	1.279	0.528+	-	-	-	-
Right foot shots on target	0.253	0.881+	-	-	-	-
Left foot shots on target	0.395	0.821+	-	-	-	-
Goals conceded inside box	0.447	0.800+	-	-	-	-
Goals conceded outside box	0.755	0.686+	-	-	-	-
Shots on conceded	0.110	0.946+	-	-	-	-
Shots on conceded inside box	0.863	0.650+	-	-	-	-
Shots on conceded outside box	1.279	0.528+	-	-	-	-
Total Shots Conceded	0.460	0.795+	-	-	-	-
Right Foot Shots	0.519	0.771+	-	-	-	-
Left Foot Shots	1.912	0.384+	-	-	-	-
Shooting accuracy right foot	0.516	0.773+	-	-	-	-
Shooting accuracy left foot	0.517	0.772+	-	-	-	-

PREPRE = 4-6 fixtures prior to the winter break, PRE = 1-3 fixtures prior to the winter break, POST = 1-3 fixtures after the winter break
** = Significant at 99% CI, * = Significant at 95% CI, + = Insignificant

Table 4.2 – Technical measures pertaining to passing assessed in the English Premier League

Technical Measure	H	P - value	Pairwise difference	Mean Analysis Direction (Mean Rank Values)	P – value (post-hoc)	Effect Size (r)
Total successful passes excl crosses and corners	1.011	0.772+	-	-	-	-
Total unsuccessful passes excl crosses and corners	0.604	0.739+	-	-	-	-
Successful passes own half	2.385	0.303+	-	-	-	-
Unsuccessful passes own half	0.955	0.620+	-	-	-	-
Successful passes opposition half	0.513	0.774+	-	-	-	-
Unsuccessful passes opposition half	0.083	0.959+	-	-	-	-
Successful passes defensive third	4.313	0.116+	-	-	-	-
Unsuccessful passes defensive third	0.326	0.850+	-	-	-	-
Successful passes middle third	1.023	0.600+	-	-	-	-
Unsuccessful passes middle third	0.867	0.648+	-	-	-	-
Successful passes final third	1.011	0.603+	-	-	-	-
Unsuccessful passes final third	0.677	0.713+	-	-	-	-
Successful short passes	0.970	0.616+	-	-	-	-
Unsuccessful short passes	0.322	0.851+	-	-	-	-
Successful long passes	0.085	0.958+	-	-	-	-
Unsuccessful long passes	1.089	0.580+	-	-	-	-
Through Ball	2.746	0.253+	-	-	-	-

PREPRE = 4-6 fixtures prior to the winter break, PRE = 1-3 fixtures prior to the winter break, POST = 1-3 fixtures after the winter break
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