Physical performance is affected by players' position, game location and substitutions during official competitions in professional Championship English football.

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Abstract:

This study aimed to verify, firstly, if physical parameters were different between positions during official matches in the English Football League Championship. Secondly, whether game location (home vs. away games) and playing status (full match vs. substitute) affected players' physical performance. Twenty-six male professional football players of the same club were included in this data analysis during the 2023-24 season. STATSports 10 Hz GNSS Apex units (Northern Ireland, UK) were used to monitor official matches (21 games). The metrics recorded were distance covered ($m \cdot min^{-1}$), high-speed running distance (>19.8 $km \cdot h^{-1}$), sprint distance (>25.2 $km \cdot h^{-1}$), the number of accelerations (>3 $m \cdot s^{-2}$), decelerations (<-3 $m \cdot s^{-2}$), and high metabolic load distance (HMLD) measured in meters (> 25.5 $w \cdot kg^{-1}$). Significant differences were found between positions and game location for distance covered and HSR ($p<0.05$) as well as between game location ($p=0.020$) for sprinting distance. Differences were found between game location ($p=0.034$) for decelerations. Differences were found between positions and game location for HMLD ($p<0.05$). Significant difference between full match players vs. substitutes were found for distance covered ($p<0.001$), for HSR ($p=0.002$), for accelerations ($p=0.017$), for decelerations ($p=0.023$) and HMLD ($p=0.008$). In conclusion, this study found that physical performance was influenced by players' positions and player status, while it found that game location impacted a minor number of physical metrics. Therefore, practitioners should be aware that training should be tailored based on the physical demands of the players' positions. Moreover, practitioners and managers need to be aware of the positive impact of substitutions on match intensity.

Keywords: soccer, performance, team sport, GPS

Introduction

Football performance depends on many factors such as technical, tactical, physiological, and psychological skills (41). Football is described as a high-intensity intermittent sport where brief high-intensity periods are interspersed by longer low-intensity ones (21). The frequent distance covered by elite outfield male player during a match is 9-12 km with varied distances covered by walking and low intensity running, nonetheless, the high intensity periods are those of most importance (33). Elite international players perform 28% more high intensity running and 58% more sprinting distance than professional players at lower levels (35). Hence, high speed running (HSR) and sprinting distances are key physical metrics to consider when training for match play(15). Other key high intensity activities such as accelerations, decelerations and changes of direction are also important considerations for a successful performance (25). The importance of accelerations and decelerations in match play has been highlighted due to the high mechanical and metabolic demands of these actions which are performed repeatedly (32). Further studies have found that acceleration and deceleration distances differentiate between positions where higher distances are reported for central midfielders and lower distances for center backs (1).

The use of player-worn monitoring devices to track training load has increased over the last decade to seek a competitive advantage (2). Through data collection and analysis, increasing multidisciplinary discussion regarding player management and training prescription may help the training regimen (i.e., development and recovery) of players (42). Football clubs have adopted tracking systems during match play and wearable based technologies such the global navigation satellite systems (GNSS) to track locomotive distances in both training and match settings (22). Among the most common parameters that can be analyzed during training and matches are: total distance, high speed running (HSR), sprint distances (SD), accelerations, decelerations and metabolic parameters, which can vary depending on specific game factors, such as the playing positions, the opponent, and the formation (18,19). Previous studies showed that full backs covered the furthest total distance, HMLD and number of decelerations, with forwards covering the furthest HSR and number of accelerations (43). Other studies have found that central defenders and central defensive midfielders covered the least amount of HSR and sprinting distances compared to forward players (20). Nonetheless, it is important for all football positions to be exposed to versatile motor preparation with particular emphasis on speed and endurance skills due to the demands of the sport (3).

Physical demands may also be affected by other contextual factors such as game location (44). Most studies have reported that home teams win over 50% of the games played under a balanced home and away schedule (44). Playing at home is commonly believed to be an advantage from a physical and psychological standpoint due to many factors; including the familiarity of the stadium and local conditions, not experiencing the tiredness from travelling, as well as the extra motivation from bigger home crowds encouraging players to perform at their best (36). However, such findings are quite unclear and may need further research. Another factor that can play a key role in the physical performance of the team is playing status. To keep high physical outputs during a game, teams make changes between starting players and substitutes (14). In the past, three substitutions could be made, however, since 2022 this rule has been changed to 5 substitutions, which could affect the team's pace strategy (14). When picked, substitutes should enhance the performances of the team as a whole (e.g., increasing the physical outputs of the team). However, there is scarcity of information in the literature on the physical performance of non-starting players, therefore, it is important to understand if substitutions impact the physical output of the team.

Further research is needed regarding how physical parameters are impacted by players' positions, game location and substitutes. Considering the lack of information reported thus far, this study aimed, firstly to demonstrate if physical parameters were different between different positions during official matches in the EFL Championship. Secondly, whether game location (home and away games) and playing status (full match vs. substitute) affected players' physical performance.

The authors hypothesized that playing position, game location, and playing status would influence the physical performance during official matches.

Methods

Experimental Approach to the Problem

To answer the research questions of this study, we compared players' external load based on their match position, game location, and player status (full-match vs substitute players). All players were included in this study independently from their game time. The external load metrics selected were assessed per unit of time played to account for the difference in time played per player. Players were divided into positions such as center backs (CB), wide backs (WB), center midfielders (CM), attacking midfielders (AM), and strikers (ST). The specific number of data points per position is reported in the Supplementary material. Matches were categorized based on their location such as home (H = 12) and away (A = 9), as well as based on player status, whether they were players that played a full 90 minutes (full-match =119) or substituted off/on (substitutes = 191; all players who did not play the entire match were included in this group). The team played most of their matches with two various formations: one for when in possession of the ball and the other during the defensive phase. For this reason, players were categorized according to their playing position match- by- match.

Subjects

Twenty-six male professional football players of the same club were included in this data analysis (age = 26.1± 4 years and body mass = 81.8 ± 7.6 kg) during the 2023-24 season of the English Football League Championship (EFL Championship). The inclusion criteria included their participation in the official competition. Goalkeepers were excluded from this study, hence, only outfield players' match data were analyzed. The external training load data were recorded as part of the regular monitoring routine of the club and was only analyzed *a posteriori*. The sample size estimation was calculated using G*power (Düsseldorf, Germany) for a ANCOVA fixed effect, where 5 positions and one covariate (match location or players status) were considered, which indicated a total of 351 individual data points would be required to detect a *small* effect ($f = 0.25$) with 80% power and an alpha of 5%. The actual sample size of this study was 620 individual data points, with a real power of >95%, which reduced the likelihood of type 2 errors (false negative)

(7). The Ethics Committee of the University of Suffolk (Ipswich, UK) approved this study (project code: RETHS22/016). Informed consent to take part in this research was signed by the club. All procedures were conducted according to the Declaration of Helsinki for human studies.

Global Navigation Satellite System (GNSS)

GNSS is a widely adopted wearable technology used for athlete monitoring purposes (2,30). GNSS allows analysis of the physical exercise demands through objective mechanical parameters, measured from GNSS and Inertial Measurement Units (28). Through measuring player movement, this allows for the objective quantification of physical stress and exertion levels on an individual athlete and further assesses positional workloads to establish training intensities (18). In this study STATSports 10 Hz GNSS Apex units (Northern Ireland, UK) were used to monitor official matches (21 games) GNSS technology tracks multiple satellite systems (i.e., Global Positioning Systems, GLONASS) to provide highly accurate and reliable positional information(18). Moreover, Apex units are integrated with a 100 Hz triaxial accelerometer (10). Previous research on 10 Hz GNSS units have found good intra-unit reliability (CV<5%) for measures of distance during 15 and 30m sprints (40). Furthermore, 10 Hz GNSS units have showed *excellent* reliability during intermittent shuttle runs (11). Before each match warm-up, the GNSS Apex units were turned on to allow the units enough time to track an adequate number of satellites. The units were worn in a custom-made vest and worn underneath the team's jersey. The units reported the number of satellites tracked that ranged between 11 and 21, average horizontal dilution of precision was 1.67 ± 0.53, which is in-line with previous literature (9). All data recorded by the Apex units were downloaded, cleaned, and arranged by STATSports software (Apex version Sonra v4.5.70) before being exported as a CSV file to analyze further. Only the official game was analyzed in this study, therefore all warm-up activities and post-match running were removed from the analysis.

External load metrics

External load metrics were quantified and reported as frequency per minute to account for the difference in time exposure among players. In this study, metrics recorded by GNSS were: distance covered ($m{\cdot}min^{-1}$), HSR distance (>19.8 $km{\cdot}h^{-1}$; 5.5 $m{\cdot}s^{-1}$), and sprint distance (>25.2 $km{\cdot}h^{-1}$; 7 $m{\cdot}s^{-1}$) (8). The number of high-intensity accelerations (>3 $m{\cdot}s^{-2}$) and decelerations (<-3 $m{\cdot}s^{-2}$) were quantified using GNSS technology (39). High metabolic load distance (HMLD) measured in meters > 25.5 $w \cdot kg^{-1}$ (corresponding to running at a constant speed of 5.5 $m \cdot s^{-1}$) (26).

Statistical Analysis

Descriptive statistics are reported as mean ± standard deviation (SD). A Shapiro-Wilk test was used to check the assumption that the data conforms to a normal distribution and that the residuals were found normally distributed for the linear mixed model (LMM). The primary analysis was an LMM, which used the Satterthwaite method (degrees of freedom estimation based on analytical results) to assess if significant differences exist between positions (CB, WB, CM, AM, and ST; fixed effects) and games' location (H and A, fixed effects) across several dependent variables (34). The secondary analysis assessed if significant differences exist between positions and player status (full-match players and substitutes). Players were considered as random effect grouping factors in both analyses. When significant differences were found in the LMM model, an estimation of marginal means (contrasts) was performed using Holm's corrections for multiple comparisons. Estimates of 95% confidence intervals (CIs) were calculated and reported in the figures (Box Plots). Effect sizes were calculated from the *t* and *df* of the contrast and interpreted using Cohen's *d* principle as follows *trivial* < 0.2, *small* 0.2 - 0.6, *moderate* 0.6 - 1.2, *large* 1.2 - 2.0, *very large* > 2.0 (27). Unless otherwise stated significance was set at $p < 0.05$ for all tests. Statistical analyses were performed in JASP (JASP Version 0.18.1. Amsterdam, Netherlands).

Results

LMM analysis showed a significant difference between positions (F=5.262, $p < 0.001$) and game location (F=10.740, p=0.028) for distance covered. Significant differences were found between positions (F = 9.569, p = 0.005) and game location (F=5.278, p=0.007) for HSR. Significant differences were not found between positions (F=0.354, p=0.553) but between game location (F=3.727, p=0.020) for sprinting distance. Significant differences were not found between positions (F=0.046, p=0.830) and game location (F=1.514, p=0.235) for accelerations. Significant differences were not found between positions (F=2.540, p=0.112) but between game location (F=3.289, p=0.034) for decelerations. Significant differences were found between positions

(F=8.106, p=0.006) and game location (F=8.320, p<0.001) for HMLD.

The summary of the comparison between positions (CB, WB, CM, AM, and ST) and game location (H and A) are reported in Figure 1 (distance), Figure 2 (HSR), Figure 3 (sprinting), Figure 4 (accelerations), Figure 5 (decelerations), and Figure 6 (HMLD). Post-hoc analysis between positions and locations are reported in the supplementary material.

LMM analysis showed a significant difference between positions (F=7.650, p<0.001) and player status (F=12.331, p<0.001) for distance covered. Significant differences were found between positions (F=3.526, p=0.021) and player status (F=11.006, p=0.002) for HSR. Significant differences were found between positions (F=3.422, p=0.026) but not between player status (F=3.874, p=0.056) for sprinting distance. Significant differences were not found between positions (F=1.254, p=0.318) but between player status (F=6.152, p=0.017) for accelerations. Significant differences were found between positions (F=2.934, p=0.048) and player status (F=5.866, p=0.023) for decelerations. Significant differences were found between positions (F=6.553, p=0.001) and player status (F=7.176, p=0.008) for HMLD.

The summary of the comparison between positions (CB, WB, CM, AM, and ST) and player status (full match vs substitute) are reported in Figure 7 (distance), Figure 8 (HSR), Figure 9 (sprinting), Figure 10 (accelerations), Figure 11 (decelerations), and Figure 12 (HMLD). Post-hoc analysis between positions and player status are reported in the supplementary material.

Discussion

This study aimed to verify if physical metrics were different between players' positions during official matches in the English Football League Championship; furthermore, this study evaluated whether game location (H and A) or playing status (full-match players and substitutes) affected player's physical performance. We found that physical performance was influenced by players' positions and player status, while we found game location only impacted a minority of physical metrics during official competitions.

Previous research reported that player positions can influence the physical demands during the game. Barros et al., found that CM covered greater distances than defenders and forward players (6). Our study has found that players' positions affect the physical outputs of the game ($p < 0.001$, see Figure 1). CB covered the lowest distance of 98.3 $m.min^{-1}$ when playing away which was significantly lower than AM ($p<0.001$, $d=0.73$, *moderate*, 110.5 $m{\cdot}min^{-1}$) and ST ($p<0.001$, $d=1.88$, *large*,113.8 $m{\cdot}min^{-1}$), while CM were the players that covered the greatest distance among all the positions (115.2 $m{\cdot}min^{-1}$). We found that game location had a significant impact on the physical performance of the team when comparing all positions together ($F=5.262$, $p=0.028$, Figure 1), however, when we analyzed individual positions for different location, most of these comparisons were not significantly different such as CM home vs CM away ($p=0.247$) and AM home vs AM away ($p=0.322$). This could suggest that game location could impact team performance, however on an individual position level, the differences are too small to be significant. HSR and sprinting distance have been found to be key determining metrics to a successful performance (15). This study found HSR was significantly impacted by players position ($F=5.278$, $p=0.005$, Figure 2). CB were found to cover the least HSR when away (4.4 $m{\cdot}min^{-1}$) among positions, whilst ST reported the greatest distance covered (8.3 $m{\cdot}min^{-1}$) which further supports Chmura et al. (16) findings. In our study, CB reported a significant difference compared to WB ($p=0.009$), CM ($p=0.007$), AM ($p=0.009$) and ST ($p=0.002$). These findings are consistent with previous studies reporting that regardless of match formation, forward players cover the greatest amount of HSR, which has been confirmed by our study (Figure 2) (43). When comparing game location, this study found that the team's HSR was significantly impacted by games being home or away ($F=9.569$, $p=0.007$, Figure 2). In this study, the only significant position to be impacted by game location were ST ($p=0.002$) whilst all other playing positions were found to have no significant changes in HSR whether playing at home or away. ST were found to cover more HSR when playing at home (9.6 $m{\cdot}min^{-1}$) than away (8.3 $m{\cdot}min^{-1}$), this could be because of the crowd's support and territorial psychological factors or due to being the players most likely to score goals and determining the match outcome (31), however, a clear explanation of these motivations is not possible yet; further research is needed to explore the psychological and contextual factors that could have determine such differences.

Sprinting distance was identified as the key movement function preceding scoring or assisting in a goal, with further research highlighting positional differences impact both HSR and sprinting distance (17,23). Regarding sprinting distance, our study confirmed that there is a significant difference between player position ($F=3.727$, $p=0.020$, Figure 3), however there were no significant difference in sprinting distance between location ($F=0.354$, $p=0.553$). Positions that cover the greatest sprint distances were WB (3.4 $m \cdot min^{-1}$) and ST (2.9 $m \cdot min^{-1}$) as they play in less congested areas of the pitch allowing them to achieve top speeds (12). On the other hand, players that play in more constricted areas such as CB (1.4 $m \cdot min^{-1}$) and CM (1.7 $m \cdot min^{-1}$) were found to have covered the least. WB were found to cover a significantly higher amount of sprinting distance compared to both CM ($p=0.034$, $d=1.26$, *large*) and CB ($p=0.015$, $d=1.34$, *large*) but not significantly higher than AM ($p = 0.132$) and ST ($p=0.462$). These results further emphasize other studies that also found that forwards, attacking midfielders, and full backs covered longer sprinting distances than central defenders and central midfielders (4). These findings should allow coaches to tailor training prescriptions based on the requirements of each position to better prepare athletes to fulfill their tactical responsibilities during the game (4).

Acceleration number (Figure 4) did not show any significant difference between location ($F=0.830$, $p=0.830$) as well as position ($F=1.514$, $p=0.235$). However, although deceleration distance (Figure 5) did not vary significantly based on match location ($F=2.540$, $p=0.112$), they were significantly different regarding player position ($F=3.289$, $p=0.034$). AM were found to have the highest number of accelerations (1.03 $n \cdot min^{-1}$) and decelerations (1.15 $n \cdot min^{-1}$) which contradicts previous studies that have found wide players to accelerate and decelerate more often than central players (45) – this could be due to the different athletes' physical levels participating in different studies or to the role of tactical factors (which has not been investigated in this study).On the other hand, CB have found to produce the least number of accelerations (0.72 $n \cdot min^{-1}$) and decelerations (0.76 $n \cdot min^{-1}$). Although being the least physically demanding position regarding all metrics, CB are highlighted as an important tactical position operating as the last line of defense, hence not needing to accelerate regularly (5). This study further analyzed metrics that evaluated distances covered during high-intensity anaerobic actions such as HMLD (Figure 6). HMLD refers to the distance covered with a power consumption above 25.5 $W \cdot kg^{-1}$ derived from the GNSS units (43). In relation to HMLD, the study found a significant difference regarding player position ($F= 8.320$, $p < 0.001$). Players found to have the highest HMLD when playing at home were CM (17.4 $m·min^{-1}$) and AM (16.6 $m·min^{-1}$), whilst WB (12.7 $m·min^{-1}$) and CB (12.4 $m·min^{-1}$) were found to have some of the lowest HMLD. Our results disagreed with other literature stating that WB were found to have the highest values of HMLD in the Spanish Second Division whilst CM players obtained the highest value in the First Spanish Division, which could be attributed to different playing styles and league physical demands (37). However, our results echo the consensus that CB have the lowest HMLD values to the defensive nature of the position hence being in situations near the goal where no longer distances need to be covered at higher intensities (24). This study further found a significant difference concerning HMLD and match location ($p=0.006$). CM were found to cover significantly ($p=0.015$) higher distances at home (17.4 $m.min^{-1}$) then away (15.8 $m.min^{-1}$). AM were also found to cover greater HMLD values at home (16.6 $m·min^{-1}$) then away ($p=0.024$, 15.1 $m·min^{-1}$). These findings could be explained by the different tactical requirements of home vs. away matches, by the different quality of the opponents as well as due to the home atmosphere set by fans, which would encourage attacking players to gain possession and score goals hence increasing the distances performed at higher intensities; however, further research need to better investigate these the role of these contextual and psychological factors on physical performance.

Prior studies have found that substitutes covered greater high intensity running distances than the starters (29). When comparing the players' position and status, it is important to distinguish between positional differences (starters vs. substitutes) as well as between positional differences (e.g., CB vs. WB) (29). Whilst analyzing total distance (Figure 7), we found that the distance covered in matches was significantly different between positions ($F=7.650$, $p<0.001$) and between player status ($F=12.331$, $p<0.001$). Our study found a significant difference in total distance covered between substitutes and players that played the whole game, specifically CB ($p<0.001$, *very large*), WB ($p<0.001$, *very large*), CM ($p<0.001$, *very large*), ST ($p<0.001$, *very large*), but not for AM ($p=0.288$). As we compared distance per minute the probable cause for such differences is due to substitutes coming on later in the game and playing less minutes hence experiencing less fatigue which allows them to cover more distance per minute. Furthermore, our study confirmed previous findings that a starting midfielder outperformed defenders and strikers in total distances with CM covering the most (112.7 $m·min^{-1}$) (29). Regarding HSR (Figure 8), our study found significant differences between position ($F=3.526$, $p=0.021$) and player status ($F=11.006$, $p=0.002$). Prior studies revealed that substitute players performed more HSR than starters (13). Our study found significantly higher HSR distances covered by substitutes compared to players playing a full 90 minutes playing in WB (8.4 vs. 7.4 $m \cdot s^{-1}$, <0.001) and CM (8.4 vs. 6.6 $m \cdot s^{-1}$, <0.001). This could be due to the strenuous impact and aggressive nature of these positions that fatigues players relatively quickly. Therefore, understanding how much of an impact a substitution to one of these positions could make on improving HSR can impact the decision making of the manager when deciding which players to put on the pitch to change the pace of the game. To provide further context, our study found no significant difference in the HSR of CB playing a whole match or being substituted on ($p=0.604$). This further suggests how coaching staff can use these statistics to make informed decisions on which player position would the team most benefit from making a substitution based on the physical demands of each position and the impact it may have on the team performance. Interestingly, AM were the only playing position where full match players covered more sprinting distance than the substitute players (2.3 $m \cdot min^{-1}$ vs. 2.1 $m \cdot min^{-1}$, $d = 2.01$, *very large*). Although the difference between both player statuses was not significant ($p=0.677$), it was interesting to know that this finding was in AM only. The reasoning for such a trend could be due to several factors, for instance to the type of players being subbed onto the pitch that may not have the physical capacity to cover as much sprinting distances, or simply because the players could not cover a greater sprinting distance for tactical constrictions due to their position or the game state. However, further research is needed to understand the impact of substitutions and tactical factors (*i.e.*, players' positions, team formation) on sprinting distance.

Acceleration number was found to not be significant between player position ($F=1.254$, $p=0.318$), however, significant differences were found between players' status ($F=6.152$, $p=0.017$), where substitute players for all positions covered a greater number of accelerations compared to players that played the full 90 minutes (see figure 10). However, none of the playing position individually were found to be significantly different between player status which suggests that substitutes for all playing positions were significantly different (at a group level) but not on an individual level (no differences were found in the pairwise comparison). With regards to decelerations player status was found to be significantly different ($F=5.866$, $p=0.023$, see figure 11)). However, at an individual level, substitute players were found to cover slightly more decelerations for WB only (1.1 vs. 0.9 $m \cdot min^{-1}$) – however, a clear explanation of this finding is not clear yet, therefore further research on the tactical and positional aspects of the game that may influence physical performance is warranted. Due to the high metabolic demands of football, it is common to see a decrement in physical performance for the players who play the whole match(16). Therefore, substituting such players off during the second half could help improve the pace of the game and create more attacking opportunities especially when other players start to fatigue (16). When analyzing player load, HMLD, which further considers accelerations and decelerations, was found to be significantly different between player status ($F=7.176$, $p=0.008$). In all positions substitute players covered more distance at HMLD than players who played a full 90 minutes. Previous studies found starters exhibit higher unstandardized load across matches however when accounting for playing time substitute players experienced a higher relative match intensity which echoes our findings (38). CM were found to be the only playing position where HMLD covered by substitutes was closed to be significantly higher than full-game players ($p=0.053$). Due to CM covering the highest HMLD compared to all the other positions, one can infer that due to the need to cover such high distances during the match, players may fatigue at a quicker rate and therefore not be able to maintain such explosive movements for prolonged periods of time. Substituting on players to replace them will allow physically fresh players to perform more explosive movements as they will be playing for a shorter duration of time. Coaching staff should be aware of the different physical demands placed on different players and their ability to cope with these demands for longer durations. This will allow them to make informed decisions on which players may need substituting and at what time during the game as well as which training fitness monitoring strategies to implement to improve the physicality of players.

This study is not without limitations: first, only one professional team was analyzed in this study, hence our results cannot be simply applied to other teams that may use different formations or have players of different abilities. Second, the metrics analyzed in this study are those most used in football and although are contextually helpful, other metrics calculated by GNSS units can offer other understandings of physical performance in football. Thirdly, our study was centered around male performance and excluded female participants. Future studies should investigate how player position, game location and player status will impact physical outputs in women's professional football. Furthermore, our study only analyzed substitutes' physical outputs without considering the time period (e.g., the final quarter of the game) in which they came on the pitch and the overall playing time. Future studies could further analyze whether the time players are subbed on will further impact physical performances and which time period and playing time would be optimal to improve team performances.

Practical applications

This study verified that physical parameters were different between player's positions during official matches in the EFL Championship, particularly, CB were the players that covered the least amount of distance, HSR, sprinting distance, accelerations, deceleration and HMLD per minute. The nature of the position and the related tactical constrictions can explain such findings. From a training perspective, this study showed how various positions excel in different metrics, suggesting that practitioners should tailor training to the specific requirements each playing position needs to perform to optimize team-level physical performance. Furthermore, this study showed that game location (home and away) and player status (full match and substitute) impacted players' physical performance, although the impact of game location is limited to some metrics. Finally, practitioners should be aware of the importance of substitutions during the match to enhance physical performance and impact some tactical aspects of the game; considering that coaches have 5 substitutions per game at their disposal, the tactical use of substitutions could play a critical role for the increment of team's pace and so for the result of the match.

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Figure 1. Comparisons of distance among players' positions and game location

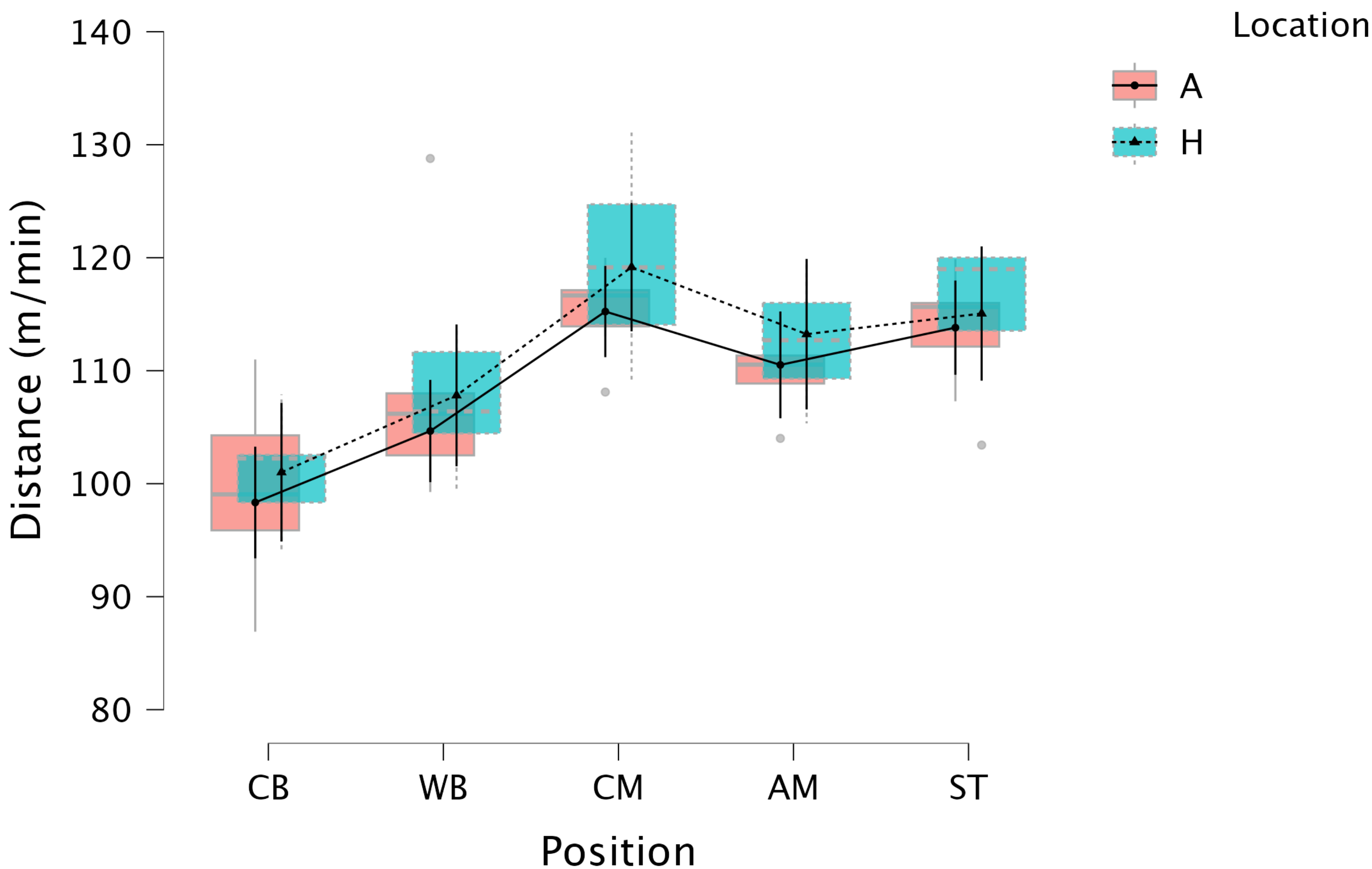

Figure 2. Comparisons of high-speed running among players' positions and game location

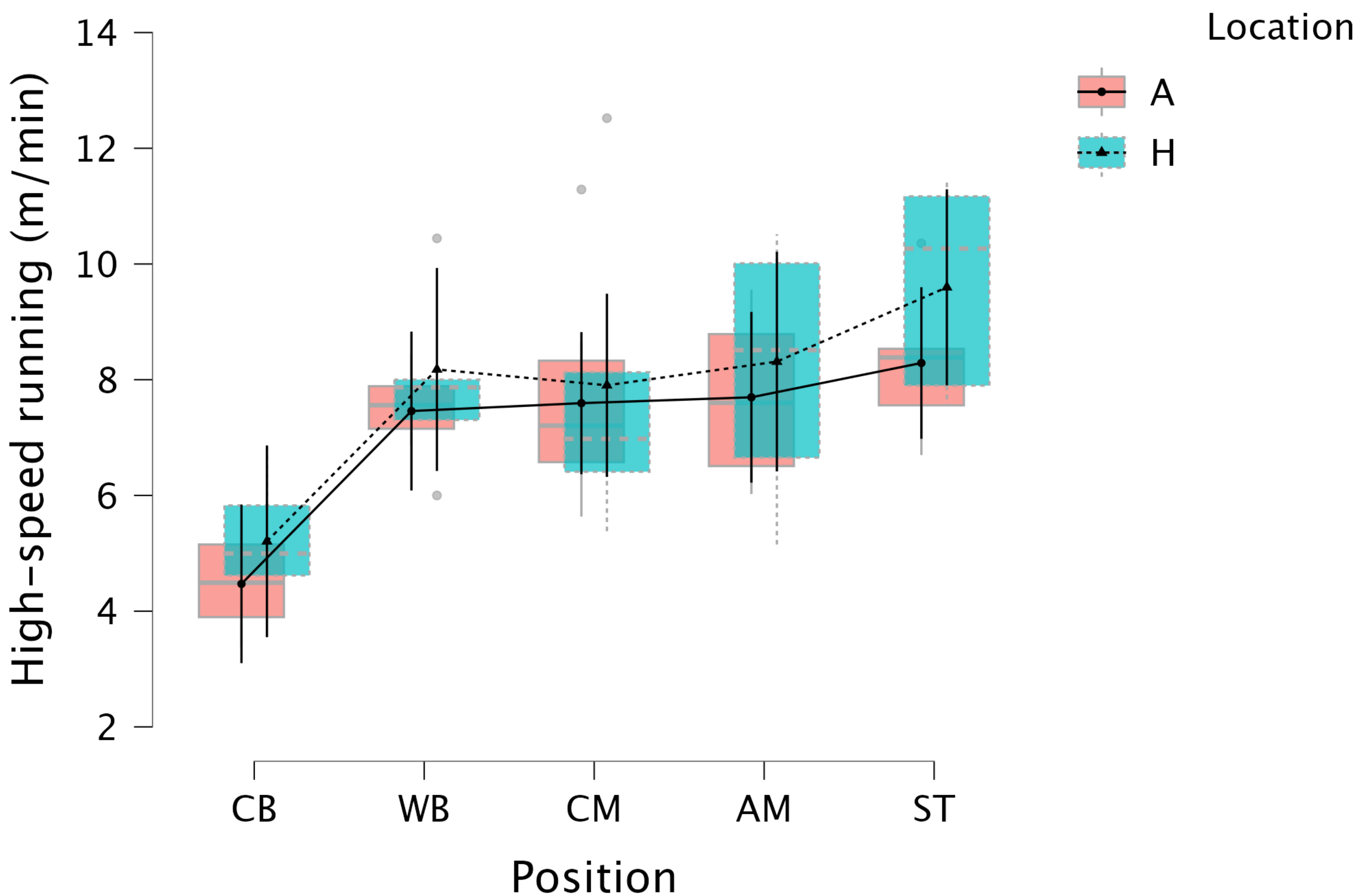

Figure 3. Comparisons of sprinting distance among players' positions and game location

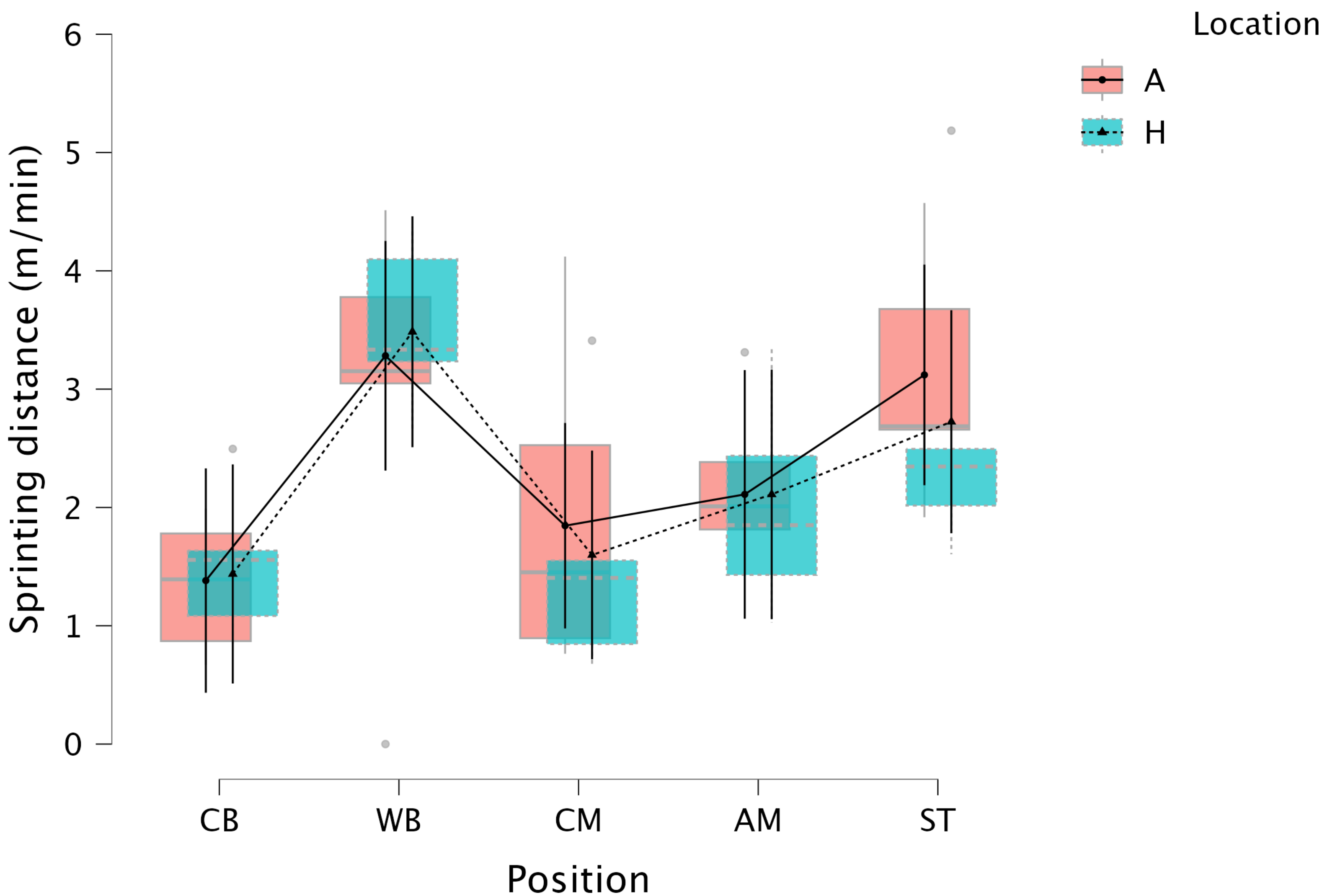

Figure 4. Comparisons of accelerations among players' positions and game location

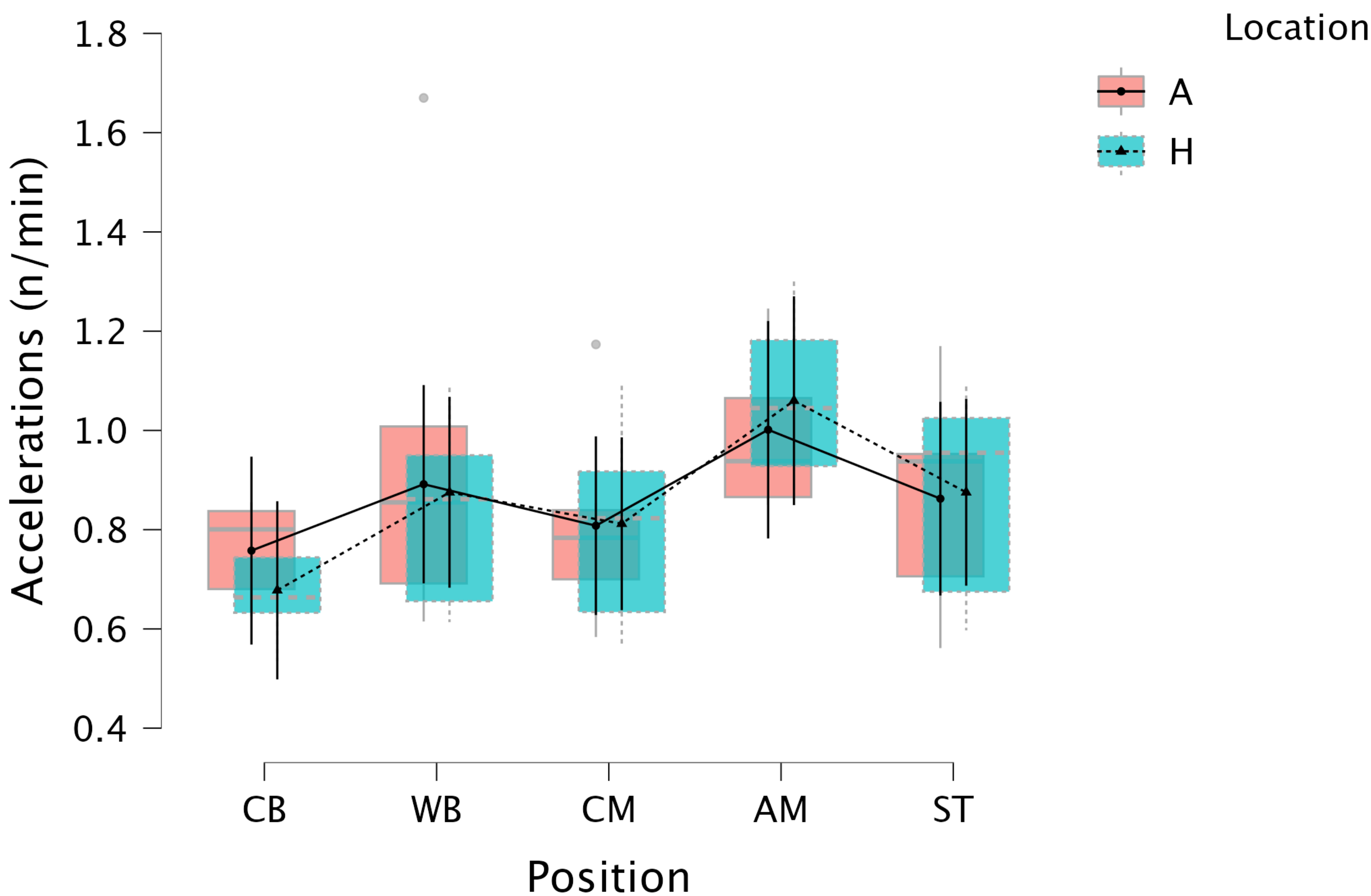

Figure 5. Comparisons of decelerations among players' positions and game location

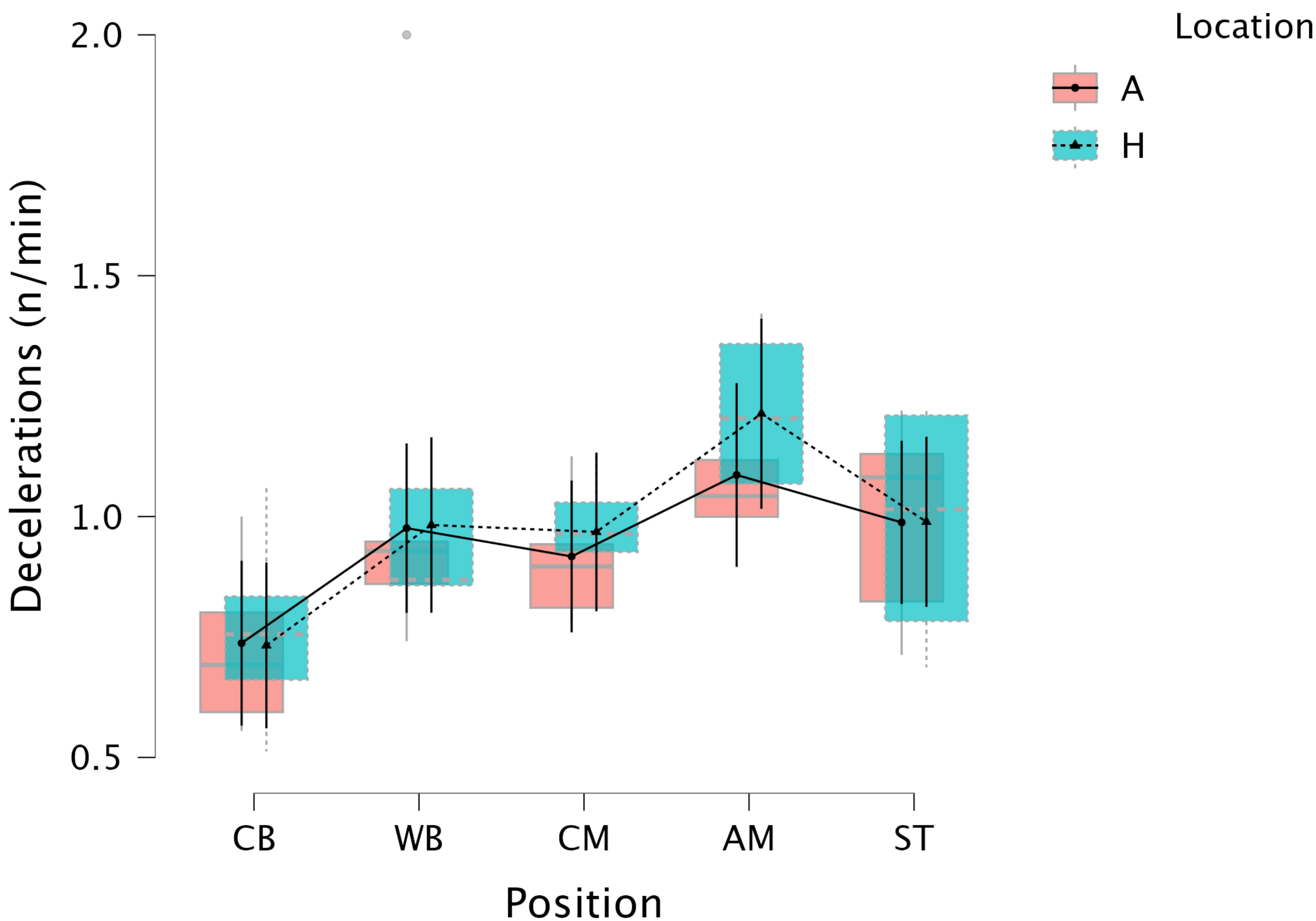

Figure 6. Comparisons of HMLD among players' positions and game location

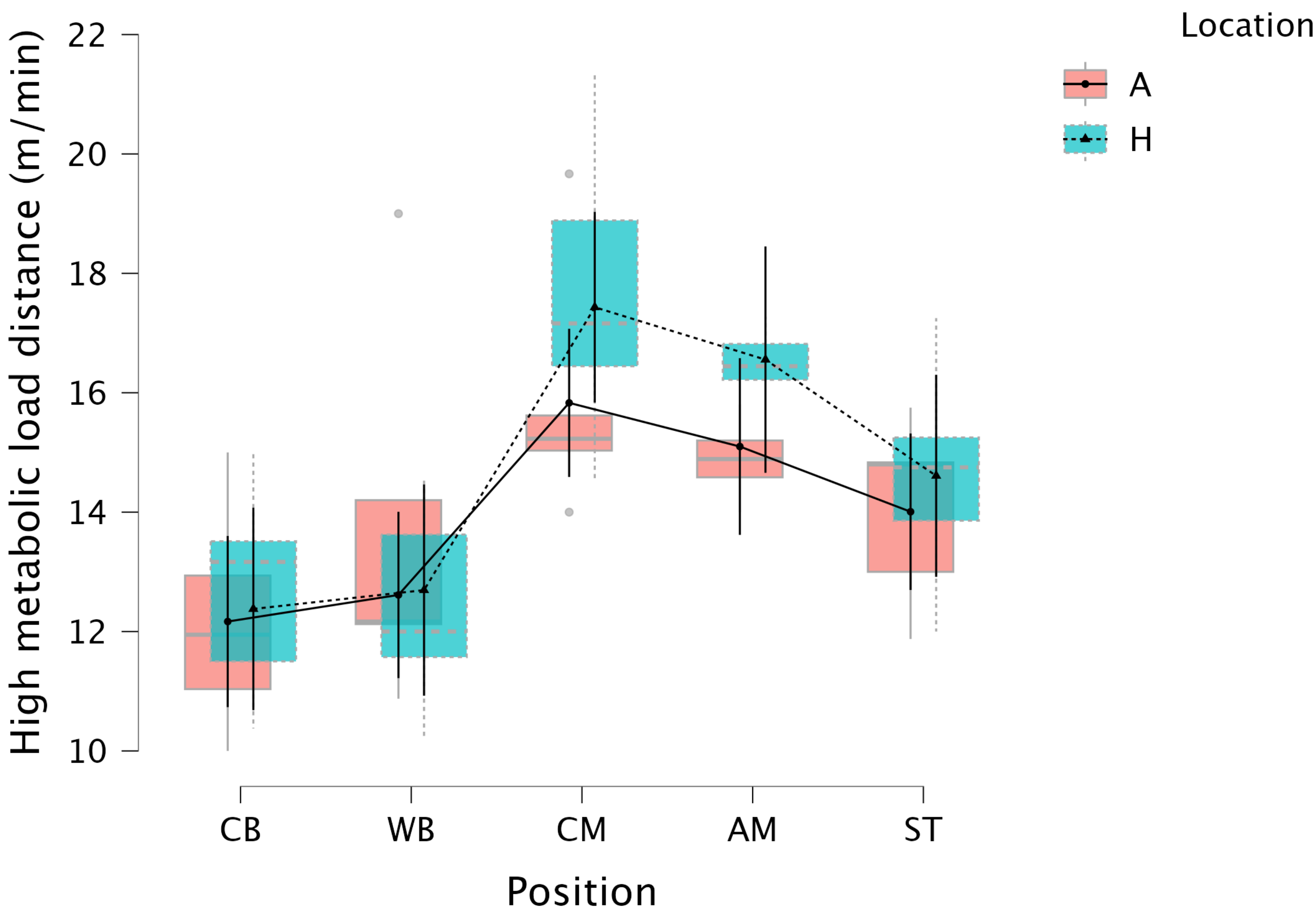

Figure 7. Comparisons of distance among players' positions and status

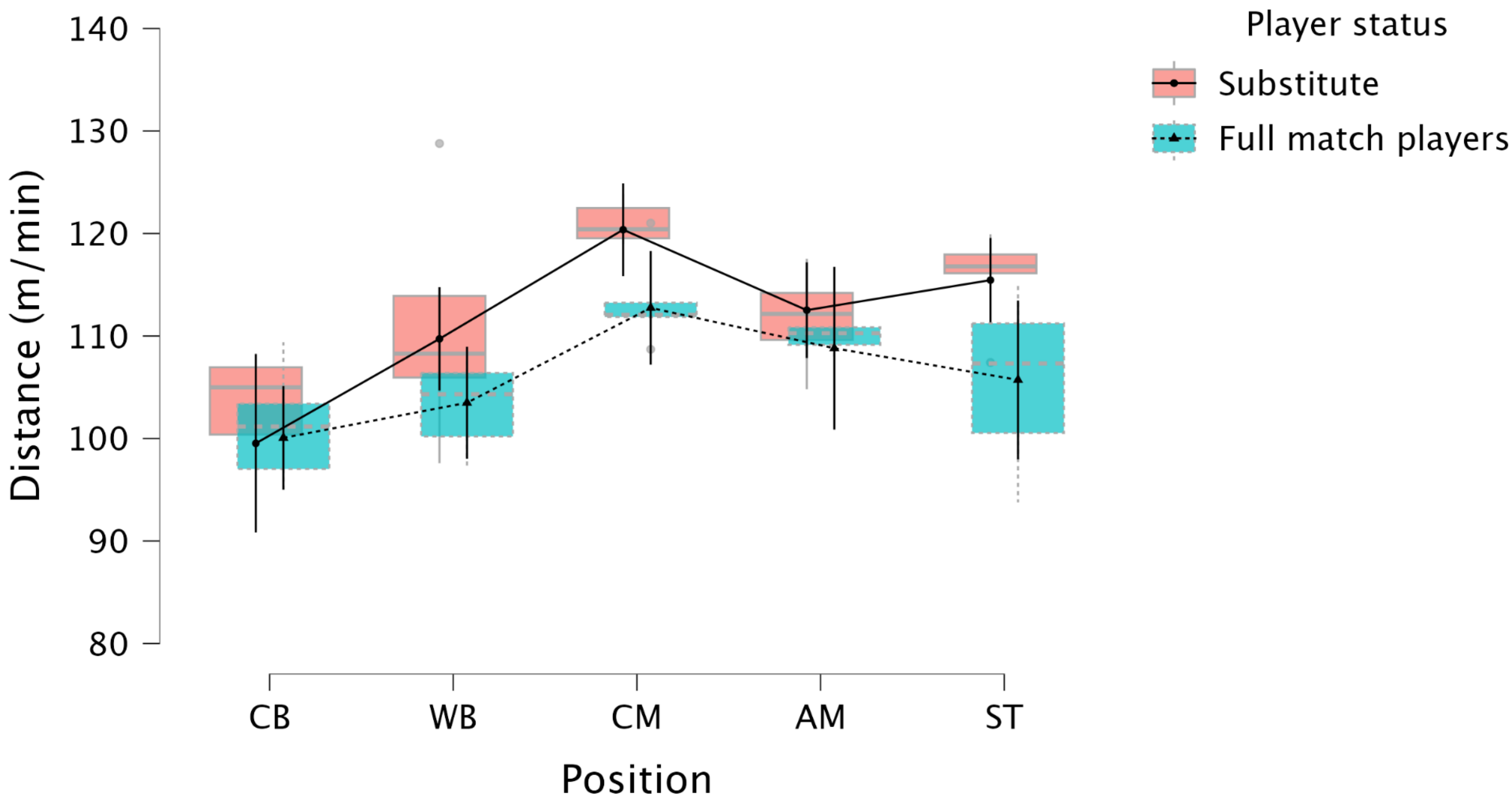

Figure 8. Comparisons of high-speed running among players' positions and status

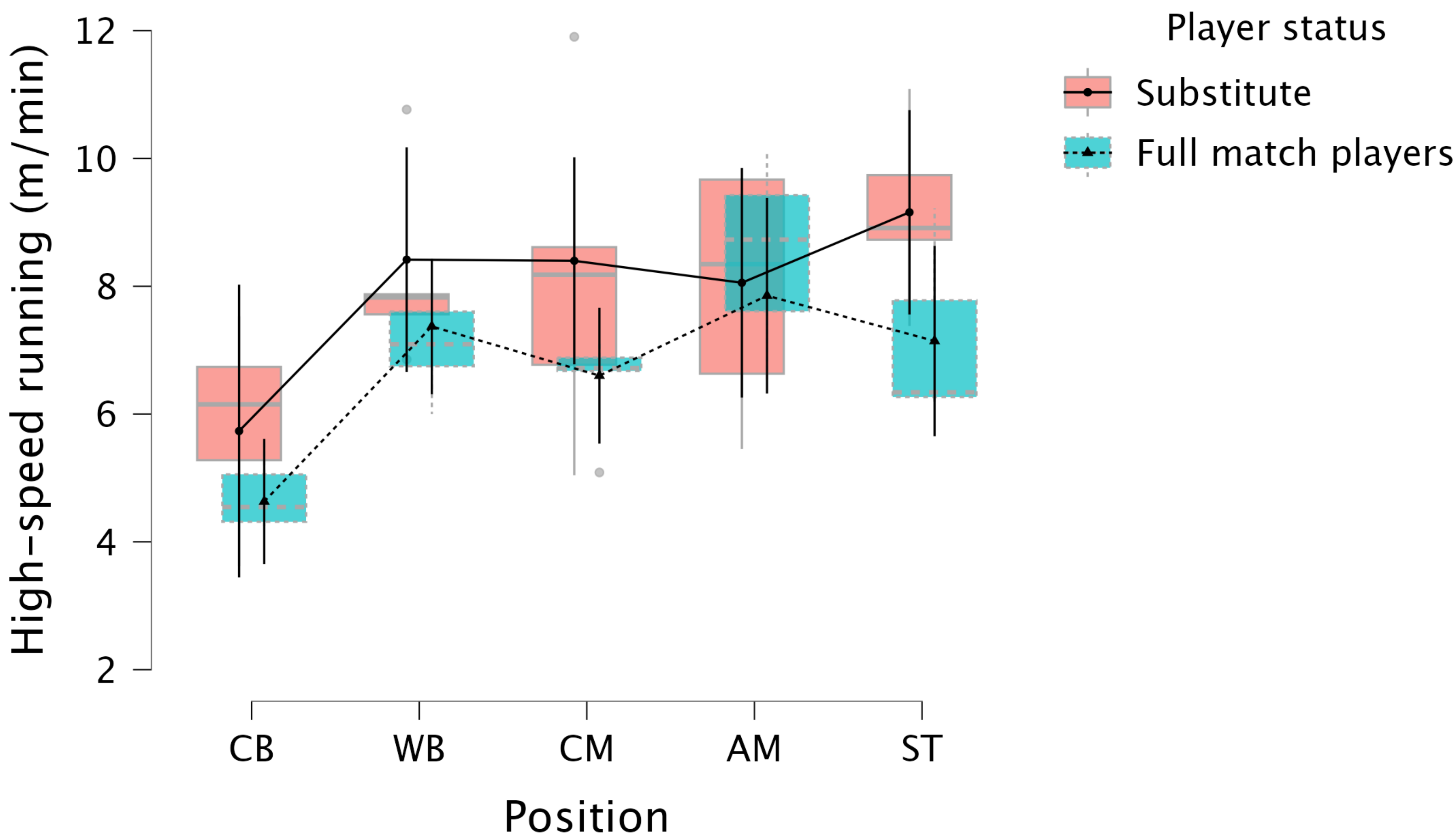

Figure 9. Comparisons of sprinting distance among players' positions and status

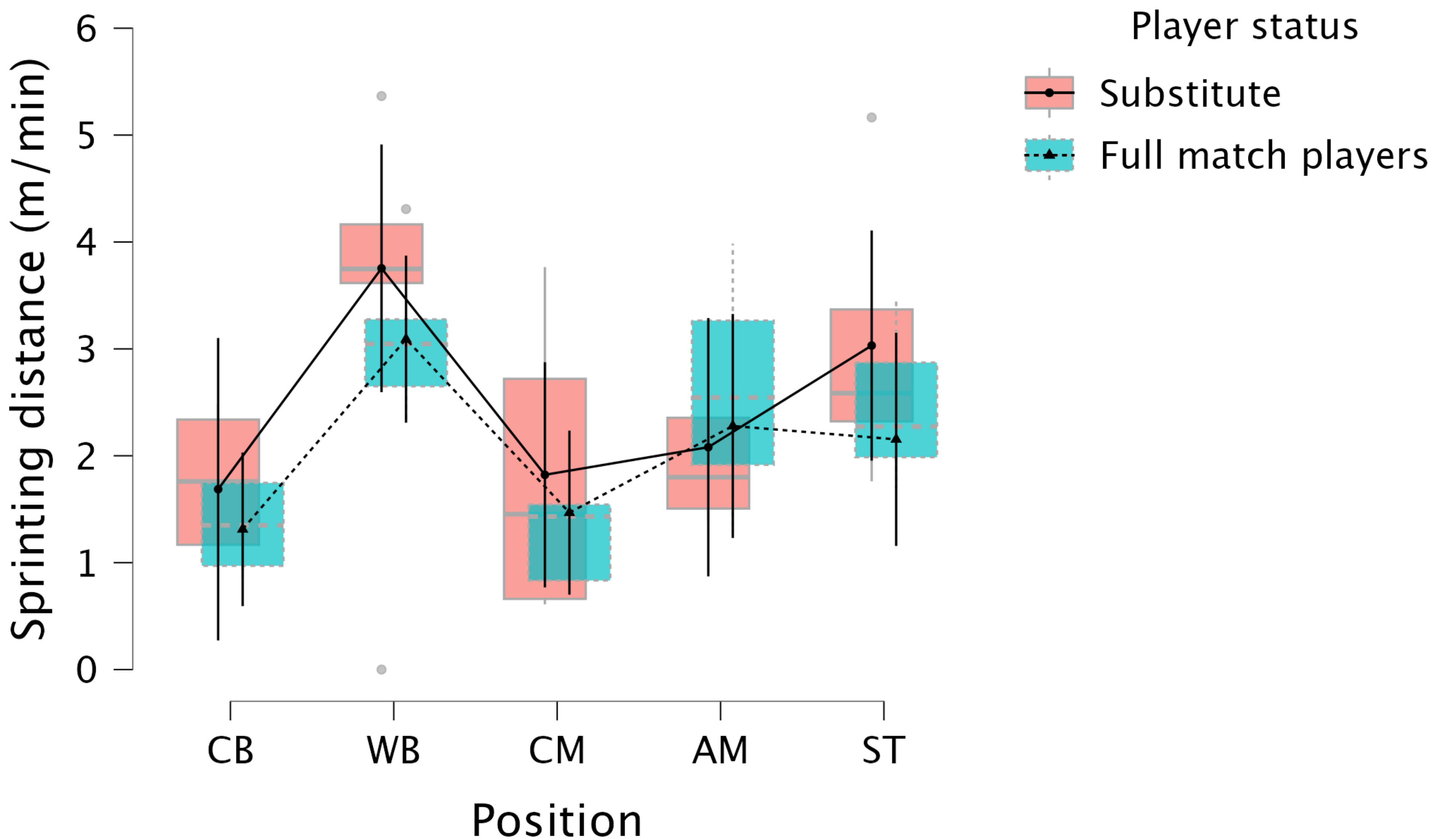

Figure 10. Comparisons of accelerations among players' positions and status

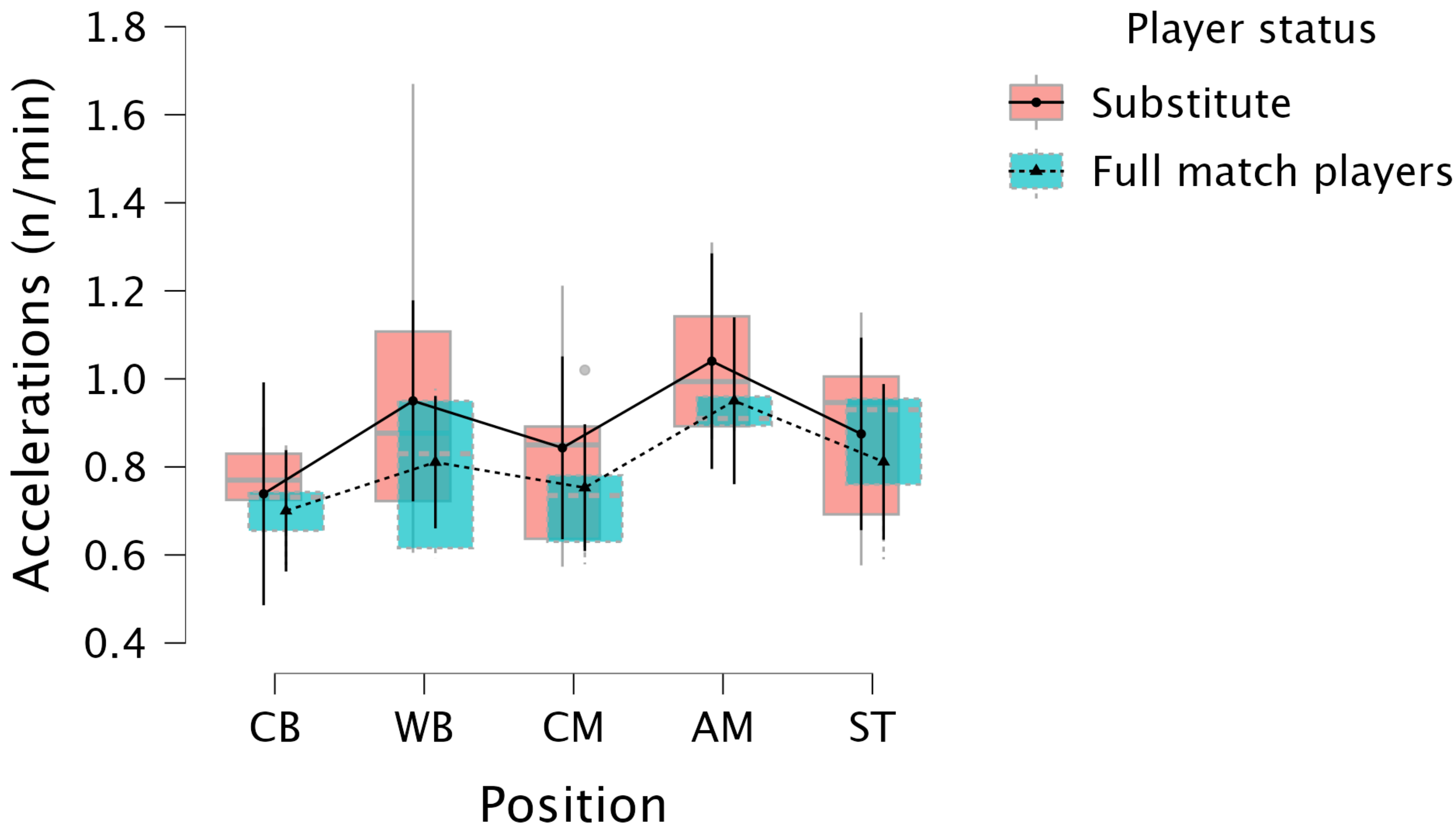

Figure 11. Comparisons of decelerations among players' positions and status

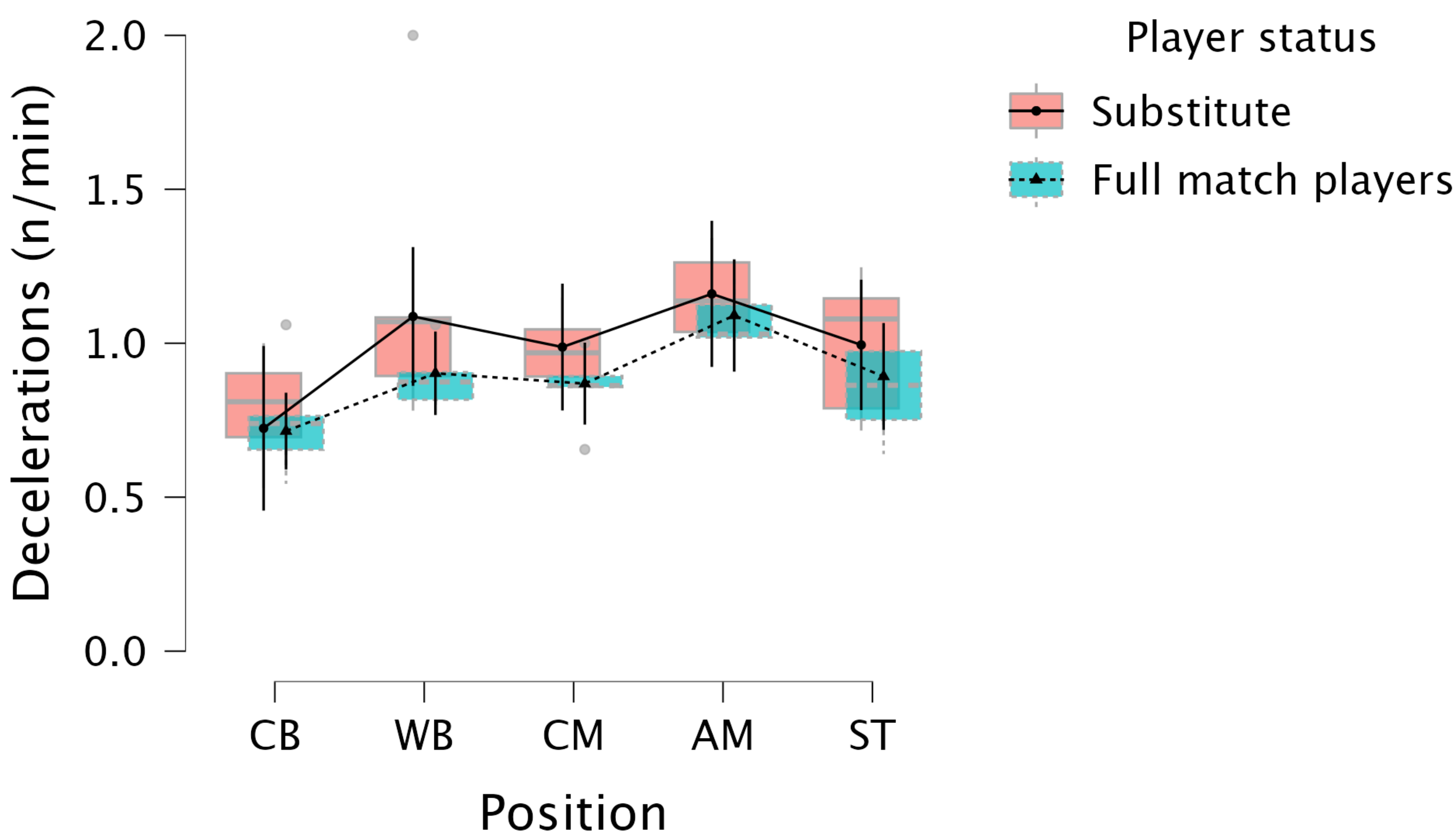

Figure 12. Comparisons of HMLD among players' positions and status