# THE EFFECT OF POSITION AND TEAM FORMATION ON THE PHYSICAL ACTIVITY PROFILES OF A DIVISION I MEN'S SOCCER TEAM

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**INTRODUCTION:** Recent advancements in athlete tracking technology have allowed sport scientists to examine the physical activity profiles of soccer athletes competing at the semi-professional and professional level. Match analyses have shown that activity profiles are not uniform across players and may differ by position (Di Salvo, Gregson, Atkinson, Tordoff, & Drust, 2009), team formation (Bradley et al., 2011), and level of play (Mohr, Krustrup, & Bangsbo, 2003). This increased understanding of soccer's positional demands has allowed sport scientists and coaching staffs to plan training in a way that meets fitness demands while simultaneously managing athlete fatigue. Unfortunately, no information has been published regarding the demands of Division I men's collegiate soccer. Thus, the purpose of this study was to compare the match activity profiles across positions of a Division I men's soccer team. A further purpose of this study was to investigate the effect of team formation on playing position activity profiles.

**METHODS:** The study involved retrospective analysis of archived monitoring data of an NCAA Division I men's soccer team. Data were collected across two competitive seasons as a normal part of the team's monitoring program. Prior to the warm-up for each match, the athletes were fitted with 10 Hz GPS units (Minimaxx S4, Catapult Innovations, Australia). These units have been previously investigated and have been found valid and reliable in measurement of distances covered during sport-specific running (Johnston, Watsford, Kelly, Pine, & Spurrs, 2014). Start and end times for each half were set by software command. GPS files were downloaded after each match and processed for coaching reports. The study was approved by the East Tennessee State University Institutional Review Board.

Two criteria were set for initial inclusion in the study: 1) the athlete had to complete both halves of play without substitution and 2) the athlete could not change their position. Further, all data were excluded for games in which the team formation changed. A total of 30 matches and 19 athletes were included. Each athlete was involved in an average of 5.7 ± 2.9 games (range: 2-14). Athletes were categorized by position (forward [ATT], $n = 4$; central midfielder [CM], $n = 5$; wide back [WB], $n = 5$; and center back [CB], $n = 5$) and formation (4-2-3-1 or 3-5-2).

Average values for each player's total distance covered (ODO) and high-intensity distance covered (HODO, velocity > 14.4 $km \cdot hr^{-1}$) were calculated. These two variables are commonly reported in time-motion analysis research, with HODO often cited as a differentiator between playing levels and one of the most important components in a team's competitive success (Bradley et al., 2011). Two 2x4 (formation x position) between-subjects ANOVAs were performed to assess differences in ODO and HODO. In the event of a significant difference, univariate *post-hoc* analyses using Tukey's HSD were employed. Cohen's *d* values with Hopkin's thresholds for effect magnitude (Hopkins, 2002) were calculated to reflect the magnitude of difference between means (0 – 0.2, Trivial; 0.2 – 0.6, Small; 0.6 – 1.2, Moderate; 1.2 – 2.0, Large, 2.0 – 4.0, Very Large).

**RESULTS:** Means and standard deviations are presented in Table 1, and mean differences and effect sizes are presented in Table 2. Formation and the interaction between formation and position did not have a statistically significant effect on ODO or HODO, whereas player position had a statistically significant effect on both ODO ($F[3,11] = 6.74$, $p = 0.007$) and HODO ($F[3,11] = 7.57$, $p = 0.005$). *Post-hoc* analysis revealed CM covered more total ground than both ATT ($p = 0.025$, $d = 2.50$) and CB ($p = 0.008$, $d = 2.77$), while CM and WB both covered greater HODO compared to CB ($p = 0.003$, $d = 2.94$ and $p = 0.031$, $d = 2.89$, respectively). While not statistically significant, magnitudes of differences between other group means ranged from Small to Very Large.

Table 1: Descriptive statistics of distance covered and high-intensity running distance by position

| Measurement | Player Position | Mean | SD | Grouped Difference* |
|---|---|---|---|---|
| Total Distance (m) | ATT | 10566 | 739 | A |
| | CM | 12023 | 594 | B |
| | WB | 11212 | 722 | AB |
| | CB | 10368 | 735 | A |
| Distance Covered > 14.4 km·hr$^{-1}$ (m) | ATT | 2048 | 153 | CD |
| | CM | 2429 | 433 | D |
| | WB | 2166 | 268 | D |
| | CB | 1514 | 235 | C |

ATT, Forwards; CM, Center Midfielders; WB, Wide Backs; CB, Center Backs

*Variables sharing the same letter are not statistically different at $a = 0.05$

Table 2: Mean differences with effect sizes between positions

| Measurement | Position Comparison | Mean Difference (m) | 95% Confidence Interval | Effect Size (d) |
|---|---|---|---|---|
| Total Distance (m) | CM-ATT ǂ | 1458 | (109, 2806) | 2.50 |
| | WB-ATT | 647 | (-701, 1995) | 1.00 |
| | ATT-CB | 198 | (-1150, 1546) | 0.30 |
| | CM-WB | 811 | (-460, 2082) | 1.37 |
| | CM-CB † | 1656 | (384, 2927) | 2.77 |
| | WB-CB | 845 | (-426, 2116) | 1.30 |
| Distance Covered > 14.4 km·hr$^{-1}$ (m) | CM-ATT | 380 | (-195, 955) | 1.26 |
| | WB-ATT | 118 | (-456, 693) | 0.59 |
| | ATT-CB | 534 | (-40, 1109) | 2.97 |
| | CM-WB | 262 | (-279, 804) | 0.82 |
| | CM-CB‡ | 915 | (372, 1457) | 2.94 |
| | WB-CB† | 653 | (111, 1195) | 2.89 |

ATT, Forwards; CM, Center Midfielders; WB, Wide Backs; CB, Center Backs

ǂ, significant at $p < 0.05$; †, significant at $p < 0.01$; ‡, significant at $p < 0.001$

**DISCUSSION:** The purpose of this study was to compare the effects of team formation and player position on match activity profiles for a Division I men's soccer team. Similar to previous findings (Stølen, Chamari, Castagna, & Wisløff, 2005) CM displayed the greatest distance traveled both in total and at high speeds, while CB and ATT covered the least total distance and CB covered the least distance at high speeds. It has been argued that HODO is a crucial component to team success (Bradley et al., 2011). Many important moments in a soccer match involve running at high speeds, such as sprinting past a defender or defending against a counterattack. Surprisingly, the values observed in the present study are similar to those observed by researchers examining match profiles of professional English players (Bradley et al., 2011; Bradley et al., 2013). These findings indicate Division I men's collegiate soccer is a physically demanding game that is heavily reliant on high-intensity running.

Some caution should be taken in interpreting the current results. Due to the small sample size, statistical non-significance was often observed despite large to very large effect sizes. Similarly, no interaction effect was observed between player position and team formation, despite previous research suggesting formation has a marked effect on HODO at different positions (Bradley et al., 2011). The small sample size aggregated from a single team may mask the interaction between formation and player position. Future research should seek to increase the athlete pool studied.

**PRACTCIAL APPLICATION:** On the surface, soccer is a highly aerobic sport. Athletes in the present study covered between 10.3 km and 12.0 km, which is similar to the distances observed in other studies (Bradley et al., 2011; Bradley et al., 2013). But as discussed above, high-intensity runs make up the most important events in a soccer match, with total HODO considered an important component of competitive success (Bradley et al., 2011). As these high-intensity events occur approximately every 70 seconds (Stølen et al., 2005), soccer players should possess high levels of both aerobic and anaerobic fitness to tolerate the physiological stress of frequent high-intensity runs (Krustrup et al., 2006) and to recover between bouts of high-intensity running. Recent training recommendations have suggested aerobic and anaerobic fitness may be developed through implementation of small-sided games and interval-style running (Buchheit & Laursen, 2013).

Further, the strength and conditioning professional should recognize each position is unique in its demands and should individualize training to best meet these demands. The midfield is by far the most demanding area of the field. As such, players at this position should be extremely fit both aerobically and anaerobically and should emphasize repeated sprint ability in their training. The ATT and WB positions should still heavily focus on aerobic and anaerobic fitness, but should also place emphasis on speed. Finally, the CB require the least aerobic and anaerobic fitness, but from anecdotal observation, require the greatest speed to act as the last line of defense against opposing forwards.

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