UNIVERSIDAD POLITÉCNICA DE MADRID

Facultad de Ciencias de la Actividad Física y del Deporte (INEF)

**PHYSICAL, TECHNICAL AND TACTICAL PERFORMANCE
ANALYSIS OF THE CHINESE FOOTBALL SUPER LEAGUE**

Tesis Doctoral

D. Yang Gai

盖阳

Madrid, 2019

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DEPARTAMENTO DE CIENCIAS DE LA ACTIVIDAD FÍSICA, DEL DEPORTE

Y DEL OCIO

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**PHYSICAL, TECHNICAL AND TACTICAL PERFORMANCE
ANALYSIS OF THE CHINESE FOOTBALL SUPER LEAGUE**

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Abstract

Soccer is one of the most extensively analyzed sports, which requires from team and player the high quality of technical, tactical and physical performance, most of the research done on performance analysis in soccer is of an applied nature, based on observational research. Its final objective is to enhance player's and teams' performance by providing knowledge which has meaning within the specific context of competition or training. In order to increase the success probability, performance analysis provides the coach and player with information about past performances and may be useful also in generating data for predictive model development. However, there exist still some limitations that need to be considered in the future research, for example: lack of situation and interaction context in which such performances happen; lack of operational definitions and conflicting classifications of activity or playing positions that make it difficult to compare similar group of studies. In order to solve these issues, the following five independent and correlated studies were undertaken in this PhD thesis.

The first study (Chapter 2) aimed to identify the key physical and technical performance variables related to team quality in the 2014 Chinese Super League (CSL). Team's performance variables were collected from 240 matches and analysed via analysis of variance among end-of-season-ranked groups and multinomial logistic regression. The results indicated significant physical performance differences among groups were identified for sprinting (top-ranked group vs. upper-middle-ranked group) and total distance covered without possession (upper and upper-middle-ranked groups and lower-ranked group). For technical performances, teams in the top-ranked group exhibited a significantly greater amount of possession in opponent's half, number of

entry passes in the final 1/3 of the field and the Penalty Area, and 50-50 challenges than lower-ranked teams. Finally, time of possession increased the probability of a win compared with a draw.

The second study (Chapter 3) aimed to identify and measure different styles of play in professional soccer. The sample comprises all of 240 matches played in the CSL during the 2016 season. Data were examined using a factor analysis. Five factors had eigenvalues greater than 1 and explained 76.1% of the total variance. The following styles of play were found: Factor 1 ("possession" style of play, correlated with the ball possession, ball possession in opponent half and in the final third of the field, positional attacks, passes, accurate passes, passes forward and back), Factor 2 (set pieces attack, correlated positively with the number of set pieces attacks, and negatively with ball possession in own-half), Factor 3 (counterattacking play, correlated with interceptions, interceptions in opponents half, recovered balls, and number of counterattacks) and Factor 4 and 5 (transitional play, correlated with lost balls, and picking up free balls). The results showed that possession style of play were more used by teams Guangzhou Evergrande and Guangzhou RF (best classified teams), and less used by Henan Jianye team (low level team). In addition, the set piece style of play was mainly used by the team Henan Jianye, and less used by Yanbian team.

The third study (Chapter 4) aimed to identify the technical and physical differences between domestic (Chinese) and foreign (no-Chinese) soccer players according to playing-positions in the 2014 CSL; and to classify domestic and foreign players (best/worst) based on their match performance characteristics. Data were provided by

Amisco Sports Analysis Services, a total of 3,468 observations were examined in the study. Discriminant and one-way ANOVA analyses showed important differences between domestic and foreign players in the CSL in terms of physical and technical performance indicators for various playing positions. More specifically, foreign players performed more passes, shots, and aerial and ground challenges when compared with domestic players. While fewer physical performance differences were observed between groups, foreign WD and WM covered greater distances than their counterparts, and domestic F covered greater distances than their foreign counterparts. Additionally, the best foreign players exhibited greater values for most variables per playing position (e.g. CD, WD, CM, WM and F) compared to the worst foreign and best/worst domestic players. Lastly, the best domestic players were better than the worst foreign players for total distance (CD, WD, WM and F), high-intensity (WM), number of high-intensity actions (WM), sprint (WM), number of sprint (WM), sprint of total distance (WM), number of passes (CM and WM), number of forward passes (CM), number of ground challenges (CD), number of shots and shot success (F).

The fourth study (Chapter 5) aimed to analyse and compare the technical and physical performances of starters, substitutes and whole-match players of different playing positions: central defender (CD), full-back (FB), central midfielder (CM), wide midfielder (WM), and forward (F). Data were collected from 240 matches of CSL played by 16 teams in the 2014 season. Match physical and technical performance data were gathered by Amisco Sports Analysis Services and Opta Sportdata, respectively. The performance of the following groups has been compared as: (i) starters (n=4,794) vs. substitutes (n=1,208); (ii) whole-match players (n=3,505) vs. substitutes (n=1,208); and (iii) players' intra comparisons: starters (n=258) vs.

substitutes (n=258). All match performances were analysed using student t-test for independent samples (groups i and ii) and paired samples t-test (group iii). The results showed that for all five playing positions substitutes covered greater distance running than starters. Additionally, the starters were more successful than substitutes in technical performances (e.g. FWD passes success and passes success, etc.).

The final study (Chapter 6) aimed to identify the key performance indicators related to technical and tactical aspects by playing position (defender, midfielder and forward) and nationality in the CSL. Data were collected from 240 matches of CSL played by 16 teams in the 2016 season. Match performance data were gathered by OPTA Sports. Data from a total of total 2,364 observations included domestic (n=1,081) and foreign players (n=1,283). All comparisons were achieved by the nonclinical magnitude-based inferences (MBI). The analyses of technical-tactical performance variables (e.g. Attacking Challenges, Attacking Challenges Successful and Challenges/Won, etc.) showed significant differences between domestic and foreign players according to playing positions.

This PhD thesis has brought some novel aspects of match performance of team and player in the elite adult male soccer competitions. Additionally, this PhD thesis has established team and player's performance profiles, which can be used in team's management, player's performance assessment, recruitment process, and also provide coaching staffs with important information related to physical, technical and tactical differences for the proper practice in the CSL.

Key words: soccer, match analysis, performance analysis, performance variables,

performance profiling, Chinese Super League

Resumen

El fútbol es uno de los deportes más ampliamente analizados, que requiere alta calidad del rendimiento técnico, táctico y físico de los equipos y de los jugadores, la mayoría de las investigaciones realizadas en el análisis de rendimiento en fútbol es de carácter aplicado, basada en investigación observacional. Su objetivo final es fortalecer el rendimiento del deportista y del equipo por medio de ofrecer el conocimiento que tiene sentido dentro del contexto específico de competición o entrenamiento. A fin de incrementar la probabilidad de ganar, el análisis de rendimiento aporta a los entrenadores y los jugadores información específica sobre el rendimiento pasado y es útil para poder generalizar los datos en el desarrollo de un modelo de predicción del rendimiento. Sin embargo, existen todavía algunas limitaciones que deben ser consideradas en los estudios futuros, por ejemplo, falta de control sobre el contexto de situación e interacción en donde el rendimiento sucede, falta de definiciones operativas y clasificaciones de actividad o posiciones de juego que dan dificultades al compararse con grupos de estudio similares. Con el fin de abordar y dar algo de luz a dichos problemas, los cinco estudios que se presentan son independientes pero relacionados en su temática y preguntas de investigación sobre la Superliga de fútbol China (Chinese Superleague, CSL).

El primer estudio (capítulo 2) trataba de identificar las variables físicas y técnicas que estaban relacionadas con la calidad de equipo (ranking) en la Superliga de China en la temporada 2014 (CSL en inglés). Se recogieron los datos de 240 partidos y se analizaron a través del análisis de comparación de medias entre los equipos clasificados al final de la temporada (diferentes niveles de equipos) y el modelo de

regresión logística multinomial. Los resultados de este estudio indicaron una diferencia significativa en el rendimiento físico entre los equipos para la variable sprint (diferencias entre equipos Top-ranking vs. Superior-medio-ranking) y la distancia recorrida sin posesión de balón (diferencias entre equipos superior y superior-medio-ranking e inferior-ranking). Para el rendimiento técnico, los equipos de Top-ranking mostraron significativamente una mayor cantidad de posesión de balón en el medio campo del oponente, número de entradas en el 1/3 final del campo y el área de penalti, y los duelos divididos 50-50 que los equipos de ranking inferior. Finalmente, el tiempo de posesión de balón incrementaba la probabilidad de ganar el partido en comparación con la probabilidad de empatar.

El segundo estudio (capítulo 3) trataba de identificar y medir los diferentes estilos de juego en la liga de fútbol profesional de China (Superliga, CSL). La muestra estaba constituida por todos los partidos de la CSL durante la temporada 2016 (n=240). Los datos habían sido examinados mediante un análisis de regresión lineal y un análisis factorial. El análisis factorial permitió obtener cinco factores (autovalores >1) que explicaron el 76.1% de la varianza. Los estilos de juego que se identificaron fueron: Factor 1 (estilo de juego “posesión”, correlacionado con la posesión del balón, la posesión en el medio campo del oponente y en el último tercio del campo, ataques posicionales, pases, pases precisos, pases adelante y atrás), factor 2 (estilo de juego acción a balón parado (ABP), correlacionado positivamente con el número de ABP, y negativamente con la posesión del balón en el propio mediocampo), factor 3 (estilo de juego de “contraataque”, correlacionado con intercepciones, intercepciones en el medio campo de oponente, balones recuperados, y número de contraataques), y factor 4 y 5 (el juego en transición, correlacionado con balón perdido, y tiro libre recibo).

Los resultados mostraron que el estilo de juego “posesión” fue el más utilizado por los equipos de Guangzhou Evergrande y Guangzhou RF (equipos mejor clasificados en el ranking), y fue el menos utilizado por Henan Jianye (equipo clasificado entre los peores equipos de la liga). Además, el estilo de balón parado fue utilizado principalmente por el equipo Henan Jianye, y menos utilizado por el equipo Yanbian.

El tercer estudio (capítulo 4) trataba de identificar las diferencias técnicas y físicas entre los jugadores nacionales y extranjeros según la posición de juego en la liga de fútbol profesional de China (Superliga, CSL) en la temporada 2014. Asimismo, también se trataba de clasificar a los jugadores chinos y los extranjeros en función de su calidad (mejores y peores jugadores) basado en sus características de rendimiento en partido a nivel técnico y físico. Se obtuvieron los datos mediante la empresa Amisco Sports Anaysis Services, obteniendo un total de 3468 observaciones que fueron examinadas en el estudio. Los análisis estadísticos empleados fueron el análisis discriminante (para diferenciar jugadores nacionales chinos y extranjeros) y el ANOVA de un factor (diferenciando entre mejores y peores jugadores por puesto de juego). Los principales resultados manifestaron diferencias importantes entre los jugadores de China y los extranjeros en la CSL en los indicadores de rendimiento físicos y técnicos en función de las posiciones específicas de juego. Más específicamente, los jugadores extranjeros rinden con más pases, tiros y desafíos en el aire y el suelo en comparación con los jugadores chinos. Cuando pocas diferencia de rendimiento se observan entre los grupos, los defensores laterales y los medio de la banda extranjeros cubrieron más distancia que sus adversarios, y los delanteros chinos

cubrieron más distancia que sus rivales extranjeros. Además, los mejores jugadores extranjeros exhiben valores mejores por tener más variables en cada posición del juego (defensor central, defensor lateral, centrocampista, medio de la banda, delantero, en comparación con los peores jugadores extranjeros, y con los mejores jugadores chinos. Por último, los mejores jugadores chinos estaban mejor que los peores jugadores extranjeros en la total distancia (defensor central, defensor lateral, centrocampista, medio de banda y delantero), la alta intensidad (medio de la banda), el número de acciones de alta intensidad (medio de la banda), el sprint (medio de la banda), número del sprint(medio de la banda), el sprint en la total distancia (medio de la banda), el número de los pases (centrocampista y medio de la banda), número de los pases hacia delante (centrocampista), el número de los desafíos del suelo (centrocampista), el número de tiros (defensor central) y la probabilidad del triunfo de tiros (delantero).

El cuarto estudio (capítulo 5) consistía en analizar y comparar el rendimiento técnico y físico en función de si eran titulares, suplentes, o los que jugaban durante los 90 minutos del partido en función del puesto de juego: defensor central, defensa lateral, mediocentro central, mediocentro lateral, y delantero. Los datos se recogieron durante los 240 partidos de la liga de fútbol profesional de China (Superliga, CSL) en la temporada 2014, recopilados por las empresas Amisco Analysis Services y Opta Sportdata, respectivamente para datos físicos y técnicos. El rendimiento de los jugadores se mostraba en tres comparaciones: (i) titulares (n=4,794) vs suplentes (n=1,208);(ii) jugadores que juega el partido completo (n=3,505) vs. suplentes (n=1,208) (iii) mismos jugadores cuando juegan como: titulares (n=258) vs. suplentes

(n=258). Las diferencias de rendimiento de partido se analizaron mediante la prueba t-test para muestras independientes (grupo i y ii) y la prueba t-test de medidas relacionadas (grupo iii). Los resultados presentaron que en las cinco posiciones de juego los suplentes corrieron más distancia que los titulares. Mientras que los titulares tuvieron mucho más éxito que los suplentes en el rendimiento técnico (e.g. pase adelante exitosos, pases exitosos....).

El último estudio (capítulo 6) trataba de identificar los indicadores claves de rendimiento relacionados con las posiciones y la nacionalidad en el aspecto técnico y táctico (defensor, centrocampista, delantero) de los jugadores en la liga de fútbol profesional de China (Superliga, CSL). Los datos se recogieron de los 240 partidos de la temporada 2016. Los datos de rendimiento habían sido recopilado por la compañía privada OPTA Sport Data, obteniendo un total de 2,364 observaciones que incluyeron los jugadores nacionales de China (n=1,081) y los jugadores extranjeros (n=1,283). Todas las comparaciones se realizaron a través de la magnitud-base-inference (MBI). Los resultados mostraron que los indicadores del rendimiento técnico-táctico, (e.g. ataque desafíos, ataque desafíos triunfo y desafíos/triunfo) presentaron la diferencia más significativa entre los jugadores de China y de extranjeros de acuerdo con las posiciones de juego.

La tesis ha permitido identificar nuevos aspectos del rendimiento de partido, perfiles de quipos y jugadores en la liga de fútbol profesional de China (Superliga, CSL). Además, la tesis establece los perfiles de rendimiento de equipos y de jugadores, lo cual puede ser de utilidad a la hora de gestionar y conformar los equipos, evaluar el rendimiento de jugadores, el proceso de fichajes, y también aporta al cuerpo técnico

la información relacionada con diferencias físicas, técnicas y tácticas específicas que pueden ser implementadas en los entrenamientos de los equipos de la CSL.

Palabras clave: fútbol, análisis de partidos, análisis de rendimiento, rendimiento variable, rendimiento de perfil, China Super Liga

Declaration

I, Yang Gai, declare that the Doctor of Philosophy thesis titled “Physical, Technical and Tactical Performance Analysis of the Chinese Football Super League” is no more than 100,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Signature:

Date:

Sponsorship

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Dedication

To my Great Motherland (China)

To my Beautiful Hometown (Dalian)

To all my Parents, Relatives and Friends

Dedicatoria

A mi Grande País Natal (China)

A mi hermoso Pueblo Natal (Dalian)

A mis Padres, Familiares y Amigos

谨献给

我伟大的祖国（中国）

我美丽的家乡（大连）

我的父母，亲戚和朋友们

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Tesis Doctoral

D. Yang Gai

CHAPTER 1

Introduction

Chapter 1 Introduction

1.1 Research Background

Soccer is an intermittent sport which has been extensively analysed by using semi-automated computerized tracking systems (e.g. tracking or GPS/ LPS systems) during competitions (Lago-Ballesteros, Lago-Penas, & Rey, 2012; Stølen, Chamari, Castagna, & Wisløff, 2005). Most of the research done on performance analysis in soccer is of an applied nature, based on observational research. Then, its ultimate objective is to enhance player and team performance (match and training) providing the coaches and players with information about competition-related performances (Hughes & Franks, 2004; McGarry & Franks, 2003; McGarry, Anderson, Wallace, Hughes, & Franks, 2002). In particular, the available research on match analysis of soccer is focused on analyzing technical, tactical, mental (Carling, Reilly, & Williams, 2009) and physiological factors (Drust, Atkinson, & Reilly, 2007) considering the situational variables (Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009).

As we known, most of the studies have examined match performance based upon physical, technical and tactical variables (Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). The *analysis of a combination of variables* is due to the complex nature of the sports that force the players to use their physical, technical and tactical skill in different manner during competitions (Bangsbo, Mohr, & Krstrup, 2006). The optimization of physical demands, technical and tactical skills of players would enhance match-play and success for teams (Bradley, Lago-Penas, Rey, & Sampaio, 2014). Therefore, the physiological demands of soccer have been studied intensively in men's competition, which has demonstrated that elite players typically cover

distances between 9 and 14 km during a match play, additionally, an elite player performs approximately 1,330 activities and 220 runs at high speed during a match play (Barros et al., 2007; Di Salvo et al., 2007; Mohr, Krstrup, & Bangsbo, 2003; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). A player can reach to 75% of maximal oxygen uptake and greatly anaerobic system during a high level competition (Bangsbo, 1994; Mohr et al., 2003). According to previous studies, many researchers were focused on analyzing player's physical performance during a match play (Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009; Russell, Rees, & Kingsley, 2013). Even now, the modern soccer match is physically demanding for players in the worldwide, however, players still need to be proficient in their technical and tactical aspects to perform in elite soccer. In particular, some specific variables are considered as the more relevant for player (e.g. passing skill and tactical awareness), which are closely related with match outcome (Bradley et al., 2013; Carmichael, Thomas, & Ward, 2001; Dellal et al., 2011; Lago & Martin, 2007; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). For example, an elite soccer player performs 35.6 (± 17.1) passes, with 9.3 (± 5.9) short passes, 19.8 (± 11.3) medium passes and 6.2 (± 5) long passes (Barnes et al., 2014; Bradley, Lago-Penas, Rey, et al., 2014). Simultaneously, the previous study suggested that passing performance is lower in the English Premier League (EPL) compared with the main European leagues. Players in the EPL performed both fewer passes in total and fewer successful passes compared to players in the Italian Serie A (Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). In addition, more long passes are observed in the EPL compared with the Italian and Spanish Leagues (Barnes et al., 2014; Dellal et al., 2011; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). However, technical, tactical and physical performances are influenced by playing styles,

formations and location on the pitch (Bradley et al., 2011).

According to the available research of the physical (Bradley et al., 2009; Carling & Dupont, 2011; Reilly, 2003), technical and tactical (Collet, 2013; Duarte, Araújo, Correia, & Davids, 2012; Lago-Ballesteros et al., 2012; Tenga, Holme, Ronglan, & Bahr, 2010; Tenga, Ronglan, & Bahr, 2010) performance indicators are influenced by *playing styles in the elite soccer*. However, there have been very few longitudinal studies of soccer play, and although the match has evolved considerably over the last fifty years (Kuhn, 2005). The style of play appears to have changed very little during the last decade if one considers the general playing style of teams competing at the World Cup (Castellano, Perea, Alday, & Mendo, 2008). Empirical match analysis of FIFA World Cup (2014, Brazil) have generally been focused on three main aspects: variables related to goal scoring (e.g. shot, shot on target); variables related to passing and organizing (e.g. pass, pass accuracy %) and variables related to defending (e.g. tackles, yellow card) (Castellano, Casamichana, & Lago, 2012; Lago-Ballesteros et al., 2012; Lago-Peñas, Lago-Ballesteros, Dellal, & Gómez, 2010; Lago-Peñas, Lago-Ballesteros, & Rey, 2011; Liu, Hopkins, Gomez, & Molinuevo, 2013a). Those variables could describe from a higher order description involving explanatory variables to performance profiles (Rein & Memmert, 2016). Additionally, teams have to choose a specific combination of attacking and defensives playing styles considering their strengths and weaknesses while considering their playing positions in order to increase their probability of success (McLean, Salmon, Gorman, Naughton, & Solomon, 2017). However, identifying specific key indicators or using modeling methods may provide information for coaches to reprioritize playing styles and also to help to re-design training exercises and then, include indicators of successful

performance (Sarmiento et al., 2018).

The available research suggested that physical and technical requirements of elite soccer match-play are influenced by *positional, contextual and tactical factors* (Bradley et al., 2011; Carling, Williams, & Reilly, 2005; Di Salvo et al., 2007; Lago-Ballesteros et al., 2012; Lago, 2009; Lago, Casais, Dominguez, & Sampaio, 2010). Researchers seek to find relationships that are established with physical activity patterns (Bradley, Di Mascio, Peart, Olsen, & Sheldon, 2010; Dellal et al., 2011; Gregson, Drust, Atkinson, & Salvo, 2010; Lago-Peñas, Rey, Lago-Ballesteros, Casáis, & Domínguez, 2011), the frequency of match actions (Bloomfield, Polman, & O'Donoghue, 2007; Dellal et al., 2011; Di Salvo et al., 2010; Vigne, Gaudino, Rogowski, Alloatti, & Hautier, 2010) and efficacy of match actions (Dellal et al., 2011). For example, central midfielders have been found to cover the greatest total distance whilst full backs, central midfielders and wide midfielders run greater distances at high-intensities (Bradley et al., 2009; Di Salvo, Gregson, Atkinson, Tordoff, & Drust, 2009). Therefore, the previous research demonstrated that positional differences in maximal oxygen uptake (VO₂max) are evident for soccer players, with central midfielders and full backs displaying the highest values (Reilly, Bangsbo, & Franks, 2000), whilst others found no differences (Haugen, Tønnessen, Hem, Leirstein, & Seiler, 2014). Additionally, central midfielders and full backs performed and completed more passes compared to other playing positions (Redwood-Brown, Bussell, & Bharaj, 2012; Taylor, Mellalieu, & James, 2004). Sarmiento et al. (2014) illustrated that the demands on the physical and technical aspects are different depending on the specific position the player takes in the field, which may enable the development of more insightful and specific training programs

for soccer players.

Several studies have suggested that physical performance such as high-intensity running and sprinting decrease from the first to the second half, probably due to physical fatigue (Barros et al., 2007; Rampinini, Impellizzeri, Castagna, Coutts, & Wisløff, 2009; Rampinini, Coutts, Castagna, Sassi, & Impellizzeri, 2007; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009), but some of them observed minimal differences (Bradley et al., 2013; Di Salvo et al., 2007). Reductions in work-rates in the second half or temporarily after the intense period could be attributed to fatigue (Bendiksen et al., 2012; Bradley et al., 2010; Di Mascio & Bradley, 2013; Krstrup et al., 2006; Mohr et al., 2003). Meanwhile, this factor of fatigue has the potential to affect the physical performance during the match play (Krstrup, Zebis, Jensen, & Mohr, 2010; Mohr et al., 2003; Mohr, Krstrup, Nybo, Nielsen, & Bangsbo, 2004). soccer is a sport with no breaks in play apart from the half-time period; thus, coaches have limited opportunities to directly impact the course of the match (Myers, 2012). Whilst coach's substitutions must adapt his team through the evolving situations occurring within the match and subsequently manage the starting players and substitute players in order to improve the team's performance (Del Corral, Barros, & Prieto-Rodriguez, 2008). Under such constraints, an effective substitution strategy may enhance the efficiency of a tactical plan, physical responses, and assist in a positive outcome (Bradley, Lago-Penas, Rey, et al., 2014; Carling, 2010; Janković & Leontijević, 2006). Recent research suggests that most of the first substitutions occur between the 60 and 75 min, and involve the midfielder players during neutral substitutions (e.g. same playing positions for reserve and substitute players) (Bradley, Lago-Penas, Rey, et al., 2014; Janković & Leontijević, 2006; Myers, 2012).

Accordingly, research suggested that teams in a losing position make the substitutions earlier than when teams are tied or ahead in the match. Additionally, defensive substitutions occur later in the match while offensive substitutions occurred earlier. Specifically, Del Corral et al. (2008) have reported that criteria for managing the first substitution are different when compared to the second and third changes. However, one of the most important limitations of previous studies is that there are no clear recommendations on how coaches can manage this substitution into practice (Gomez, Lago-Peñas, & Owen, 2016).

During the last decade, several studies have emphasized *the importance of situational conditions* that may influence performance at a behavior level (Bradley et al., 2010; Di Salvo et al., 2010; Lago-Peñas, Rey, Lago-Ballesteros, Casais, & Dominguez, 2009; Zubillaga, Gorospe, Mendo, & Villaseñor, 2007). Given that soccer is dominated by strategic factors, Lago-Peñas (2012) suggested that situational variables may influence the teams' and players' activities. Specifically, the empirical evidence suggests that the situational variables of match location (e.g. playing at home or away), match status (e.g. whether the team was winning, losing or drawing), and the quality of the opposition (strong or weak) are very important factors for match performances in soccer (Lago-Peñas, 2012). The available research has suggested that the importance of these situational variables is reflected in changes in the teams' and players' activities as a response to match situations (Lago-Peñas et al., 2009; Lago & Martin, 2007; Taylor, Mellalieu, James, & Shearer, 2008). For example, the effects of match location commonly referred to as "home advantage", several studies (Lago-Peñas, Lago-Ballesteros, et al., 2011; Lago & Martin, 2007; Pollard, 2006) have confirmed that teams play at home performed better than playing away in some

performance indicators such as shots on goal (Lago-Peñas, Lago-Ballesteros, et al., 2011; Poulter, 2009; Taylor et al., 2008), crosses (Lago-Peñas, Lago-Ballesteros, et al., 2011; Taylor et al., 2008), passes, successful passes, dribbles with success, or corner kicks (Lago-Peñas & Dellal, 2010; Lago-Peñas, Lago-Ballesteros, et al., 2011; Lago & Martin, 2007; Poulter, 2009). With respect to disciplinary behavior, when teams playing at home commit fewer fouls (Poulter, 2009) and receive less yellow cards (Lago-Peñas, Rey, et al., 2011; Poulter, 2009). From the above reviewed studies there was indicated that strategies in soccer are influenced by match location and teams may alter their playing style accordingly (Sarmiento et al., 2014). In addition to home advantage, researchers have attempted to study the influence of the other situational variables, particularly in quality of opposition and match status, researchers used categories of match status defined based on the intervals: losing $]-\infty; -1]$, drawing $[0]$ and winning $[1; +\infty[$, which are considered appropriate for matches like soccer that end with a low score (Marcelino, Mesquita, & Sampaio, 2011), and they conclude that when losing the teams had more ball possession (Lago-Peñas et al., 2009; Lago-Peñas & Dellal, 2010; Lago & Martin, 2007) and performed more crosses (Taylor et al., 2008) and dribbles (Taylor et al., 2008). In regards to quality of opposition, Lago-Peñas, Rey, et al. (2011) classified the quality of opposition into “strong” or “weak” team based on the difference between the final league’s ranking of the team under study and the final league’s ranking of the opponent team. More recent studies consider three (Castellano, Blanco-Villasenor, & Alvarez, 2011) or four groups (Lago-Peñas, Lago-Ballesteros, et al., 2011) according to the final position in the league’s ranking. The studies on the quality of the opposing teams showed that when playing against strong opponents, they perform more passes (Taylor et al., 2008), less dribbles (Taylor et al., 2008) and covered greater distances (Castellano et al., 2011;

Lago-Peñas et al., 2010; Lago-Peñas, Lago-Ballesteros, et al., 2011). Sarmiento et al. (2018) indicated that these findings about situational variables are important for coaches, when developing strategic and tactical aspects in order to improve the performance of their teams in relation to the diversity of situational variables that their teams may encounter.

Globalization scholars have used world systems theory to portray the post-Bosman *labor market in male professional soccer* as an amalgam of global value added chains developed by clubs, player agents and investment agencies to transfer the biggest talents from (semi-)peripheral countries to play in the core leagues of world soccer (Littlewood, Mullen, & Richardson, 2011; Maguire & Stead, 1998; Poli, 2010). For example, the EPL has undergone substantial change over the last decade in technical and physical aspects (Barnes et al., 2014). Players from EPL performed both fewer passes in total and fewer successful compared to players in the Italian Serie A (Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009), and performed more long passes are observed in the EPL compared with the Italian and Spanish Leagues (Barnes et al., 2014; Dellal et al., 2011; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). Therefore, the players from EPL covered at high intensity and sprinting increasing by 30–50% and the number of passes rising by 40% (Barnes et al., 2014), with subsequent research identifying that these evolutionary trends are position and tier specific (Bush, Barnes, Archer, Hogg, & Bradley, 2015). In addition, the increased proportion of the non-UK players in the EPL is related to the Bosman ruling which abolished foreign player quotas for clubs, allowing teams to buy the non-UK players without restriction (Binder & Findlay, 2012; Littlewood et al., 2011). Nevertheless, the future research could also pay more attention to careers developing

in other parts of the world outside (East Asia: Japan, South Korea, China) of the top European leagues (Velema, 2016).

Along these lines, the *soccer sport in Asia* is in constant development due to the players' migration to play in Japan, South Korea, India or China. Specifically, the Chinese Super League limits the number of foreign players per team (Velema, 2016). Each year, teams from CSL recruits many foreign players (e.g. ageing stars and South American mercenaries) (Vamplew, 2017) to improve team quality. Additionally, the Chinese Football Association (CFA) makes foreign players' policy according to current status of Chinese soccer, for example, a maximum of 4 foreign players (non-goalkeeper players) from anywhere in the world, with a maximum of 3 foreign players and 1 Chinese player (under-23) among the starting 11 players on the field, the number of under-23 Chinese players must equal to foreign players before the end of the match. Given this specific foreign player policy, one that is more restricted than most other elite competitions (Vamplew, 2017), teams within CSL exhibited distinctive match performance profiles with potential significant differences between Chinese (domestic) and non-Chinese (foreign) players across various playing positions (Gai, Leicht, Lago, & Miguel-Ángel, 2018).

1.2 Limitations

From above research on match analysis in adult male soccer has been mainly focused on the description of physical, technical and tactical aspects, the match analysis of soccer provided important match information to coaches, managers and researchers. However, a lack of operational definitions, conflicting classifications of activity or playing positions, and limited studies that consider interactional context in their

analyses, which are the main limitations of the reviewed studies, future research should:

(i) To provide comprehensive operational definitions for the analysis variables, for example, the integration of comprehensive operational definitions for the analysis variables, the standardization of the groups established by player positions and the use of the same movement categories are imperative in order to progress to a more comparable and replicable research in the future (Sarmiento et al., 2014).

(ii) To use standardised categories and classifications of activities and participants, for example, the reviewed studies have revealed conflicting classifications of activity that make it difficult to compare similar group of studies (Sarmiento et al., 2018).

(iii) To consider integrating in the analysis the situational (match location, quality of opponent, match status and match half) as well as interactional contexts in which the performances happen, for example, the new methodological advances have enabled overcoming some of the typical match-analysis limitations (O'donoghue, 2009) as well as improving ways of establishing groups regarding quality of opposition (Marcelino et al., 2011).

1.3 Aims of Current PhD Thesis

According to the above-mentioned introduction, the aim of the current thesis is to identify the match performance (physical, technical and tactical) of elite male soccer teams/players in the CSL with consideration of different contextual and situational variables. Additionally, the complemented aims are as follows:

- (i) To identify the key physical and technical performance variables related to team quality in the Chinese Super League (CSL).
- (ii) To identify and measure different styles of play in the Chinese Super League (CSL).
- (iii) To identify the technical and physical differences between domestic and foreign soccer players according to playing-positions in the Chinese Super League (CSL).
- (iv) To identify the key performance indicators related to technical and tactical aspects by playing position and nationality in the Chinese Super League (CSL).
- (v) To identify the technical and physical performance differences between starters and substitutes according to playing positions in the Chinese Super League (CSL).

1.4 PhD Thesis Structure

This PhD thesis is composed by eight chapters including (see Figure 1.1). **Chapter one** is the general introduction, including the information about research background, limitations of existing literatures, objective and structure of thesis. The **Chapter two to six** make up the main part of the thesis and they are independent studies presented in manuscript formats of the scientific journals to which they were submitted. Therefore, each article includes its own distinct introduction, methods, results, discussion, conclusion, practical application and limitations according to the publication

requirements of the corresponding journal. The detailed information of the journals where they are published or under review is illustrated at the start of each chapter. *Chapter seven* includes the conclusions, which to illustrate the main findings, limitations, and future directions. *Chapter eight* includes the findings from previous chapters, which illustrates practical applications. Additionally, the formats of these chapters are different due to the different formatting requirements of the scientific journals to which they were submitted. The detailed information of the publications is listed at the end of this chapter. Lastly, all of the citations and references from each chapter are placed together at the end of this PhD thesis.

Figure 1.1 Structure of the PhD Thesis.

Table 1.1 Studies for corresponding chapters.

Chapter	Title	Journal	Impact Factor	Status
2	Key team physical and technical performance indicators indicative of team quality in the soccer Chinese super league	Research in Sports Medicine	1.871 (Q2)	Published
3	Styles of play in professional soccer: an approach of the Chinese Soccer Super League	International Journal of Performance Analysis in Sport	1.144 (Q4)	Published
4	Physical and technical differences between domestic and foreign soccer players according to playing positions in the China Super League	Research in Sports Medicine	1.871 (Q2)	Published
5	Technical and physical performances differences between players' status and positions in the Chinese Football Super League			Under review
6	Technical and tactical performance indicators describing the differences by playing position and nationality in the Chinese Football Super League			Under review

Tesis Doctoral

D. Yang Gai

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CHAPTER 2

Key team physical and technical performance indicators indicative of team quality in the soccer Chinese super league

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Chapter 2 Key Team Physical and Technical Performance Indicators Indicative of Team Quality in the Soccer Chinese Super League

2.1 Introduction

Soccer is an intermittent sport characterized by physical, technical and tactical elements that contribute to a team's performance (Stolen et al., 2005). Match success has been reported to be a result of these elements with sport science coaching staff encouraged to monitor and develop key performance indicators to improve the chances of team success (Carling et al., 2009; Carling et al., 2005; Hughes & Bartlett, 2002). Accordingly, several studies have attempted to assess match success based upon team's physical performance indicators (Grant, Williams, Reilly, & Borrie, 1999; Hook & Hughes, 2001; Hughes & Churchill, 2005; Hughes, Robertson, & Nicholson, 1988; Hughes & Franks, 2005; Jones, Mellalieu, & James, 2004; Lago-Peñas et al., 2010; Stanhope, 2001). However, very few have examined playing patterns or the technical indicators needed for success with previous studies reporting contradictory findings (Clemente, Figueiredo, Martins, Mendes, & Wong, 2016).

For example, Hughes and Franks (2005) compared the performance of successful and unsuccessful teams in the 1990 soccer World Cup and reported that converting possessions into shots on goal was an important factor with successful teams having a higher conversion rate. (Hughes & Churchill, 2005) compared the pattern of play leading to shots and goals for successful and unsuccessful teams during the 2001 Copa America Tournament. They reported that there were no significant differences between patterns of play leading to shots for successful and unsuccessful teams

(Hughes & Churchill, 2005). In contrast, Hook and Hughes (2001) demonstrated that successful teams exhibited a greater match time with ball possession than unsuccessful teams in the UEFA European Football Championship 2000 (Belgium and Netherlands), although no significant differences were evident for the number of passes used in attacks or offensive attempts leading to a goal. In a similar study, Stanhope (2001) reported that match time with ball possession was not associated with match success in the 1994 World Cup. Lastly, Jones et al. (2004) demonstrated that successful teams within the English Premier league typically exhibited longer match times with ball possession than unsuccessful teams, irrespective of the match status (evolving score).

To date, most studies have examined either physical or technical indicators for team performance (Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009; Russell et al., 2013) with none considering both categories and their contribution to team quality/success after a complete season (e.g. competition ranking). Hewitt, Hollingsworth, Chapin III, and Taylor (2016) indicated that the variables examined in previous studies were results of convenience instead of a focused effort for a better understand of the contributors to teams' performance. Similarly, Fernandez-Navarro, Fradua, Zubillaga, Ford, and McRobert (2016) highlighted the importance of studying physical, technical and tactical indicators in order to objectively analyse the team's performance holistically. Further, Rein and Memmert (2016) emphasized the importance of the conceptual connections between technical-tactical and physical parameters in determining performance and success. Subsequently, an examination of physical and technical performances that contribute to teams' profiles and quality/success would assist physical trainers, coaches and performance analysts in

improving performance. Therefore, the aim of the present study was to identify the key physical and technical performance indicators that contributed to team success or quality (e.g. end-of-season ranking) at the end of a full competitive season. Based upon prior studies (Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009; Russell et al., 2013), it was hypothesized that key physical and technical parameters such as distance covered at different intensities and shots on target would be identified and contribute to greater season success and ranking. Identification and development of these indicators would assist coaching staff to enhance their future team for greater competition success.

2.2 Material and Methods

2.2.1 Sample

Data were collected from 240 matches of the Chinese Super League (CSL) during the 2014 season. The regular season was played over 30 rounds with a balanced home and away schedule for 16 teams. The performance variables (physical and technical) were gathered by Amisco Sports Analysis Services with their data collecting methods previously validated via monitoring devices (O'Shaughnessy et al., 2011; Radicchi, Fortunato, & Castellano, 2008).

The physical performance variables were categorised according to the match periods and the possession of the ball as follows: total match, total match in possession, and total match without possession. For each of these categories, the following variables were studied: total distance covered; total distance covered at high-intensity (e.g. high-speed running and sprinting); total distance covered while sprinting (>25.1 km. h^{-1}); total distance covered at high-speed (19.8 - 25.1 km. h^{-1}). For the technical

performance indicators, the following were examined: total number of shots, number of shots on target, number of corner kicks, number of cross passes, total match time of possession, percentage of total match time with possession in opponent's half (OPP), total number of passes, percentage of passes completed, total number of forward passes (FWD), percentage of total number of FWD (%FWD), pass efficiency (FWD/total number of passes), number of entry passes in the final 1/3 of the field (Final 1/3 Entries), number of entry passes into the Penalty Area (Penalty Area Entries), percentage of even (50-50) challenges won, number of fouls committed, number of Yellow Cards, number of Red Cards and number of Offside calls. These indicators have been previously examined as valid indicators of match technical or skill performance in soccer (Castellano et al., 2012; Lago-Peñas et al., 2010; Lago-Peñas, Lago-Ballesteros, et al., 2011; Liu, Gomez, Lago-Penas, & Sampaio, 2015b; Liu, Hopkins, Gomez, & Molinuevo, 2013b).

2.2.2 Statistical Analysis

After determining the normal distribution of the data (via Kolmogorov Smirnov test), a cluster analysis (k-means) was undertaken to classify the team's quality based upon their end-of-season-ranking. The model identified four groups: upper-ranked teams (ranked 1st to 4th), upper-middle-ranked teams (ranked 5th to 8th), lower-middle-ranked teams (ranked 9th to 12th), and lower-ranked teams (ranked 13th to 16th). Secondly, a one-way factor analysis of variance (ANOVA) with Bonferroni corrected, pairwise comparisons was employed to compare group (team quality) differences for physical and technical performance indicators. Effect sizes (ES) based upon the partial eta squared (η_p^2) were calculated to show the magnitude of the effect with the following interpretation criteria adopted: 0.01-0.05 = small effect, 0.06-0.13 = medium effect,

≥ 0.14 = large effect (Cohen, 1988). Finally, a multinomial logistic regression was applied to identify the relationships between match outcome (win, draw or loss) and the key physical and technical performance indicators identified as significant in the ANOVA (comparisons among rankings). This non-linear model allowed us to estimate (via regression coefficients) the change in the corresponding explanatory variable (Landau & Everitt, 2004) and produced odds ratios (OR) and their 95% confidence intervals (CI) for each performance indicator. All statistical analyses were performed using IBM SPSS for Windows, version 20.0 (Armonk, NY: IBM Corp) and statistical significance was set at $p < 0.05$.

2.3 Results

Table 2.1 presents the teams' physical performance indicators based upon team quality (end-of-season ranking). All variables were similar between groups except for the total distance covered while sprinting and total distance covered without possession ($p < 0.05$ and small effect size values). Specifically, teams in the top-ranked group covered more total distance while sprinting compared to the upper-middle-ranked group while both groups covered less total distance without possession compared to the lower-ranked group (Table 2.1).

Table 2.1 Mean $\pm$ SD team physical performance indicators according to team quality.

Variables	Top-ranked		Upper-middle-ranked		Lower-middle-ranked		Lower-ranked		p	η_p^2
	1-4		5-8		9-12		13-16			
	M	SD	M	SD	M	SD	M	SD		
Total Distance (m)	108,009	5,577	107,588	6,660	107,850	6,578	109,116	6,148	0.637	0.009
Total Sprint (m)	2,183	546	1,993†	448	2,074	518	2,052	520	<0.001*	0.018
Total High-Intensity (m)	4,810	1,015	4,488	923	4,599	957	4,591	994	0.167	0.014
Total High Speed (m)	2,643	514	2,572	448	2,525	511	2,530	525	0.099	0.009
Total Distance in possession (m)	35,394	6,065	36,360	5,996	34,822	5,564	35,302	6,117	0.135	0.009
Total Sprint in possession (m)	1,081	373	1,002	289	1,053	334	1,002	298	0.231	0.011
Total High-Intensity in possession (m)	2,262	597	2,168	503	2,141	536	2,094	539	0.102	0.013
Total Distance without possession (m)	36,372	6,551	35,944	6,025	37,936	5,764	39,425‡#	6,270	<0.001*	0.048
Total Sprint without possession (m)	1,000	342	913	269	964	310	977	313	0.231	0.010
Total High-Intensity without possession (m)	2,332	645	2,187	520	2,239	583	2,297	573	0.310	0.009

Note: *p<0.001; [†]p<0.05, [‡]p<0.001 vs. top-ranked; #p<0.001 vs. upper-middle-ranked

Table 2.2 presents the teams' technical performance indicators based upon team quality (end-of-season ranking). All variables were similar between groups except for the percentage of possession, OPP, Final 1/3 entries, Penalty Area Entries, 50-50 challenges, and fouls committed ($p < 0.05$ and small effect size values). Teams in the top-ranked group exhibited greater OPP compared to lower-middle-ranked teams, and greater OPP, Final 1/3 and penalty area Entries, and 50-50 challenges than lower-ranked teams. In addition, the upper-middle ranked teams performed better than lower-middle-ranked teams for possession time and better than lower-ranked teams in terms of possession time, Final 1/3 Entries, 50-50 challenges and fouls committed (Table 2.2).

Table 2.2 Mean $\pm$ SD teams' technical performance indicators according to team quality.

Variables	Top-ranked		Upper-middle-ranked		Lower-middle-ranked		Lower-ranked			
	1-4		5-8		9-12		13-16		p	η_p^2
	M	SD	M	SD	M	SD	M	SD		
Total number of shots	12.88	4.9	12.17	4.7	12.24	4.9	11.50	4.2	0.295	0.011
Number of Shots on target	4.65	2.3	4.09	2.2	4.12	2.5	4.28	2.1	0.172	0.009
Number of corner kicks	4.93	2.8	4.86	2.8	4.52	2.7	4.32	2.1	0.283	0.009
Number of cross passes	13.67	6.7	12.73	6.1	12.77	6.1	11.98	4.9	0.207	0.010
Total match time of possession (%)	50.49	8.1	51.75	6.3	49.22#	6.3	48.53#	7.1	0.003*	0.030
Percentage of total match time with possession in opponent's half (OPP)	46.36	8.4	44.22	6.4	42.72‡	7.6	42.26‡	7.1	<0.001**	0.044
Total number of passes	356.89	107.2	369.58	84.2	354.03	79.1	346.10	95.7	0.312	0.008
Percentage of passes completed	76.93	6.5	77.89	5.1	77.51	5.7	77.63	6.1	0.507	0.007
Total number of FWD Passes	120.67	30.6	124.40	24.1	124.42	22.4	119.05	30.7	0.631	0.007
Percentage of total number of FWD (%FWD)	63.46	9.9	63.13	7.8	62.04	7.2	61.88	9.8	0.389	0.006
Pass efficiency (FWD/total number of passes)	34.91	6.9	34.27	4.5	35.63	4.1	35.08	6.2	0.233	0.008
Number of entry passes in the final 1/3 of the field (Final 1/3 Entries)	46.20	16.1	44.39	13.1	43.76†	13.6	39.34†#	12.6	0.003*	0.032
Number of entry passes into the Penalty Area (Penalty Area Entries)	7.22	3.8	6.43	3.7	6.35	3.2	5.87†	3.0	0.023*	0.019
Percentage of even (50-50) challenges won	54.95	5.6	54.83	5.9	53.55	5.1	52.53†#	5.5	<0.001**	0.031
Number of fouls committed	17.07	4.1	17.26	5.1	17.02	3.5	15.77#	4.9	0.024*	0.017
Number of Yellow Cards	2.06	1.3	2.16	1.1	2.17	1.3	2.05	1.2	0.946	0.002
Number of Red Cards	0.08	0.3	0.06	0.2	0.12	0.3	0.12	0.3	0.367	0.006
Number of Offside calls	2.35	1.7	2.32	1.52	1.96	1.7	2.31	1.7	0.392	0.009

Note: *p<0.05, **p<0.001; †p<0.05, ‡p<0.001 vs. Top-ranked group; #p<0.05 vs. upper-middle ranked group

The results of the multinomial logistic regression detected significant key performance indicators that were related to match outcome (e.g. win, draw or loss). The significant model ($\chi^2_{16}= 71.410$; $p<0.001$; $R^2=0.157$) identified that time of possession increased the probability of a win compared with a draw (OR=27955.1) or loss (OR=70689.9) (Table 3). In addition, a greater number of Final 1/3 Entries was associated with a draw (OR= 0.97) while the total distance covered while sprinting was associated with a loss (OR= 0.99). Finally, the proportion of 50-50 challenges won increased the probability of a draw (OR= 0.01) or a loss (OR=126.89) compared with a win and a draw, respectively (Table 2.3).

Table 2.3 Identification of the key significant technical indicators that contribute to match loss, draw and win via multinomial logistic regression.

Loss vs Win	Sig.	OR 95% CI		
		OR	Lower	Upper
Constant	0.54			
Total sprint	0.02*	0.99	0.99	1.00
Total distance out of possession	0.57	0.99	0.99	1.00
% possession	0.01*	706.9	102.38	1329.3
% possession opponent half	0.53	5.65	0.03	12.05
Final 1/3 entries	0.44	0.99	0.95	1.02
Penalty area entries	0.49	1.04	0.94	1.14
% of 50-50 challenges won	0.01*	0.00	0.00	0.01
Fouls committed	0.50	0.98	0.92	1.04
Draw vs Win				
Constant	0.68			
Total sprint	0.29	1.00	1.00	1.00
Total distance out of possession	0.80	1.00	1.00	1.00
% possession	0.01*	279.08	15.34	509.2
% possession opponent half	0.22	15.75	0.19	30.17
Final 1/3 entries	0.05*	0.97	0.94	1.00
Penalty area entries	0.89	1.01	0.92	1.10
% of 50-50 challenges won	0.04*	0.01	0.00	0.79
Fouls committed	0.36	0.98	0.93	1.03
Draw vs Loss				
Constant	0.74			
Total sprint	0.10	1.00	1.00	1.01
Total distance out of possession	0.67	1.00	1.00	1.01
% possession	0.15	.004	0.00	7.69
% possession opponent half	0.65	2.78	0.03	239.09
Final 1/3 entries	0.25	0.98	0.95	1.01
Penalty area entries	0.49	0.97	0.89	1.05
% of 50-50 challenges won	0.02*	126.89	1.92	224.13
Fouls committed	0.91	0.99	0.94	1.05

* p<0.05

2.4 Discussion

This study identified the key physical and technical performance indicators that best differentiated teams according to their seasonal quality/strength (quartile ranked groups: 1st to 4th, 5th to 8th, 9th to 12th, and 13th to 16th) in the Chinese Super League. Higher ranked teams exhibited unique physical (greater total sprint distance, less total distance covered without possession) and technical (greater match time of possession, Final 1/3 entries and 50-50 challenges) performance indicators compared to lower ranked teams. Collectively, these performance indicators highlighted key qualities for coaches to develop for match and season success at the elite level.

The first physical performance difference noted between ranked groups was for the total distance covered without possession which was significantly greater for lower ranked teams (13th to 16th) compared with better ranked teams (1st to 4th and 5th to 8th). This finding likely represented a greater match time undertaking defensive activities by the lower ranked teams, possibly during imbalanced matches. These results suggest that players moderate their maximal physical capacity during the match (Bloomfield, Polman, & O'donoghue, 2005; Lago-Peñas et al., 2010) based upon the match characteristics in combination with the opposition. The limited number of physical-related differences between different team rankings in the current study reinforces that soccer is not exclusively dependent on physical capacities but rather a complex interaction of many performance indicators (physical, tactical and technical) that need to be addressed by coaches and players for success.

Total sprint distance was significantly greater for the best ranked teams (1st to 4th) compared to lower ranked teams (5th to 8th). This finding highlighted the importance

of sprinting for tactical team-work that generates open spaces, penetrative passes, and potential 1-on-1 situations (Gómez, Gómez-L, Lago, & Sampaio, 2012). Accordingly, this result reinforces the importance of physical preparation to enhance group-tactic behaviour for the best teams during key actions that lead to scoring opportunities and potential goals (Di Salvo et al., 2009). Notably, Faude, Koch, and Meyer (2012) identified the importance of sprinting during goal actions with straight sprints, rotations, changes of directions and jumps performed against direct opponents key for technical-tactical actions during decisive situations. The current findings reinforce the importance of sprinting for technical parameters that contribute to final actions (e.g. final 1/3 and penalty entries).

While key physical indicators contributed to team success within the CSL, the current study also confirmed the importance of technical indicators with ball possession vital to match and team season success. Successful teams experienced greater ball possession in the opponent's half, Final 1/3 Entries and Penalty Area Entries that supported playing styles focused on ball possession as important for team success compared to those focused on direct styles of play (Fernandez-Navarro et al., 2016). Several studies have reported that possessions with relatively longer duration were related with team success (Bloomfield et al., 2007; Hook & Hughes, 2001; Hughes & Churchill, 2005; Lago-Peñas et al., 2010; Lago & Martin, 2007; Tenga & Sigmundstad, 2011). Hughes and Churchill (2005) reported that successful teams in the Copa America 2001 kept the ball for longer and created shots after possessions lasting more than 20 seconds more frequently than unsuccessful teams. Significantly longer possessions were performed by successful rather than unsuccessful teams during the 2000 European Championship (Hook & Hughes, 2001) and the English

Premier League in the 2001-2002 season (Jones et al., 2004), the Norwegian top professional league during the 2008 to 2010 seasons (Tenga & Sigmundstad, 2011) and from the Spanish La Liga in the 2003-2004 season (Lago-Peñas et al., 2009; Lago & Martin, 2007). Further, Bloomfield et al. (2007) reported that the top three teams within the English Premier League during the 2003-2004 season (Chelsea, Manchester, and Arsenal) dominated ball possession against their opponents regardless of match-status scenarios (e.g. winning, losing and drawing). Jointly, these results emphasized ball possession as a determinant of success in elite soccer worldwide. Successful teams may direct matches by controlling ball possessions that approach the opponent's half and the creation of shots on target opportunities (Bradley, Lago-Penas, Rey, et al., 2014). The results identified in the Chinese Super League in the current study (Tables 2 and 3) provided further evidence of ball possession as a vital variable that characterizes the best teams at the elite level. Subsequently, coaches are encouraged to develop preparatory activities for their athletes and match technical strategies to maintain ball possession that generates more offensive actions with ending attacks close to the goals, shots on target and eventually match/season success.

Previously, successful teams were reported to spend more match time playing in the attacking zone (possession in the opponent's half) than their opponents (Lago, 2009). In fact, team possession originating from the final third of the playing field was found to be effective in goal scoring (Jones et al., 2004; Tenga & Sigmundstad, 2011). Accordingly, Gómez et al. (2012) suggested that the ability of football teams to recover the ball in the defensive half, to organize the attacks through long possessions with penetrative passes into the goal and penalty areas, and to increase the number of

shots and consequently goals, was key to succeed in the Spanish La Liga. Similar styles of play were identified by Fernandez-Navarro et al. (2016) in the Spanish and English professional leagues suggesting that better field positioning and more ball possession work allowed for better performances and success in elite football.

Finally, 50-50 challenges won and fouls committed were greater for better ranked teams (1st to 4th; 5th to 8th respectively) than lower ranked teams (13th to 16th) highlighting a more aggressive style of play for team success. Better positioning on the pitch and playing challenges with more contact and assertiveness may lead to greater clearing of the ball to teammates and a positive scoring style of play. Further, as these variables are related (Liu, Gomez, Lago-Penas, & Sampaio, 2015a), the greater assertiveness of the team may lead to higher use of fouls and stoppages by the team. According to Liu, Hopkins, and Gomez (2016), winning teams were more likely to dominate the defensive and attack actions that led to more controlled possessions with tactical fouls committed, and clearances with less tackle actions. Therefore, a greater probability of losing (see logistic regression results) may occur when the team loses more 50-50 challenges quickly during matches with more tackles, aerial duels or lost balls that represents a less controlled style of play (Liu, Hopkins, et al., 2016). Therefore, ball possession and the style of play may be paramount for success at the elite level with the current results in the CSL providing further evidence of the key indicators for match and season success, which seem to be homogenous worldwide.

While key indicators were identified in the current study, several physical and technical variables were similar between teams of different rankings. Mao, Peng, Liu, and Gómez (2016) reported that team differences for specific physical and technical

indicators were minimal within the Chinese Football Super League compared with international competitions or European Leagues. Therefore, the lack of diversity within the league may be an important consideration when examining key indicators within a competition/league (Fessi et al., 2016; Moalla et al., 2016). Understanding the diversity of the league, as well as the key indicators, will ensure coaches and trainers develop players and team performances for optimal success within the league. Finally, the use of classifications in this study (quartiles) may have lacked the necessary sensitivity to differentiate physical and technical performances as a function of team quality (Mao et al., 2016). Future studies are encouraged to examine alternative classification approaches such as the use of league ladder positions or smaller groupings.

The present study provided a unique analysis of physical and technical performance indicators during a competitive soccer season. However, some limitations should be highlighted for further research. First, the current study examined indicators over one season only within the same professional competition. An examination of indicators across multiple seasons and/or competitions may demonstrate greater applicability of the current results within elite soccer (Lundberg & Weckstrom, 2017). However, the current study and its analysis of match-by-match performances have provided groundwork evidence and a clearer indication of the evolution of team success. Additionally, other contextual parameters (e.g. match type or match location) were not examined in the current study and should be considered for a multifactorial examination of a team's performance during elite competitive seasons (e.g. relationships among physical, technical and tactical variables).

2.5 Conclusion

In conclusion, this study confirmed the influence of key physical and technical performance indicators on soccer team quality in the Chinese Supper League. The results have provided key areas of focus for coaching staff to assist in the training of athletes and development of tactical strategies for success during elite competition over a full season

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CHAPTER 3
***Styles of play in professional
soccer: an approach of the
Chinese Soccer Super League***

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Chapter 3 Styles of play in professional soccer: an approach of the Chinese Soccer Super League

3.1 Introduction

Soccer is a dynamic and complex sport where teams and players have to organise their activity according to strategical plans, principles of play and action guidelines decided upon before a match, and to adapt their tactics to the immediate requirements of an ever-changing opposition (Memmert, Lemmink, & Sampaio, 2017). This means that teams have to choose a specific combination of attacking and defensives playing styles considering their strengths and weaknesses in order to increase their probability of success (McLean et al., 2017).

The playing style can be defined consequently as the main characteristic playing pattern demonstrated by a team in the five moments of the play (Hewitt et al., 2016): (1) Established Attack, (2) Transition from Attack to Defense, (3) Established Defense, (4) Transition from Defense to Attack, and (5) Set Pieces. It will be regularly repeated into specific situational contexts (e.g. match location: playing at home or away; score-line: winning, losing or drawing; or depending on the quality of the opponent) such that measurements of variables reflecting games will be relatively stable (Lago-Peñas, 2012).

The available research demonstrates the influence of playing styles when physical

(Bradley et al., 2009; Carling & Dupont, 2011; Reilly, 2005), technical and tactical (Collet, 2013; Duarte et al., 2012; Lago-Ballesteros et al., 2012; Tenga, Holme, et al., 2010; Tenga, Ronglan, et al., 2010), performance indicators are examined in elite soccer. In fact, Rein and Memmert (2016) argued the importance of performance analysis in team sports using tactical information trying to describe soccer team's dynamics from a higher order description involving explanatory variables and performance profiles.

However, there is a lack of studies describing and measuring playing styles in elite soccer. Definitions and measures of key performance indicators that may define the distinguishing features of playing patterns are still inconclusive and make difficult to characterize the playing styles in soccer. The objectivity measuring and definition of playing styles may allow coaches, sport scientists, media and spectators to have a clearer understanding of the play (Hewitt et al., 2016).

In a recent study (Fernandez-Navarro et al., 2016), different playing styles were defined in elite soccer (Spanish La Liga and the English Premier League) by using factor analysis. However, some inconsistencies in their methodology and procedures can be observed: (i) the sample is relatively small as it did not include the full season for each league (n=97 matches); (ii), data were collected from two different periods (season 2006-2007 and 2010-2011); (iii) the reasons that may explain the selection of teams and tournaments are unclear (e.g. not described in the procedure); (iv) sampled

teams did not keep a balanced schedule (e.g. playing the same number of matches both, at home and away) and the strength or quality of opposition; (v) probably some performance indicators, such as number of attacks, lost balls or picking up free balls, should have been included; and (vi) the statistical approach used by the authors was not focused on normative profiles in order to establish the importance and ranges of values for each performance indicator according to the median and interquartile ranges (O'Donoghue, 2005).

Due to the scarce research about this topic and the limitations raised from the available studies it is pertinent to investigate the playing styles from all the teams of the league during the same season using a wide range of performance indicators that allow to explain the complex relationships and dynamics from each team. This approach would give a real impact with stakeholders (e.g. coaches, players, performance analysts, media) and will offer an explanatory model that integrates technical and tactical variables as a description of playing styles (Rein & Memmert, 2016). Therefore, the aim of the current study is to describe and measure playing styles in professional soccer. It has been hypothesized that teams can be classified according to their game style and that the quality of the teams (strong or weak) may define the style of play adopted by coaches.

3.2 Material and Methods

3.2.1 Sample

The sample comprises the match statistics of all 240 matches played in the Chinese Super League during the 2016 season. The Chinese Super League consists of 16 teams that compete for the national soccer championship. Teams play each other twice a season (e.g. balanced schedule), once during rounds 1–15 and once during rounds 16–30 when the status of home and visiting team is reversed. The outcome of a match (e.g. a win, a draw, or a loss) determines the number of points that are allocated to the teams: No points are allocated to the loser of a match, while each team receives one point or three points in case of a draw or a win, respectively. The accumulated number of points during a season determines the league ranking. A season lasts for about eight months (March through October) and teams typically play one match per week.

3.2.2 Measures

Twenty-two variables (16 attacking and 6 defensive) were included in the study and selected according to the available literature (Castellano et al., 2012; Fernandez-Navarro et al., 2016; Lago-Peñas, 2012; Liu et al., 2013a; Tenga, Holme, et al., 2010; Tenga, Ronglan, et al., 2010): Ball possession (minutes), Ball possession in own half (seconds), Ball possession in opponent half (seconds), Ball possession time in the final third of the field (seconds), Attacks, Positional attacks, Counter-attacks, Set pieces attacks, Passes, Accurate passes, Crosses, Crosses accurate (percentage), Interceptions, Interceptions in opponents half, Picking up free balls, Picking up free balls - in opponents half, Lost balls, Lost balls in own half,

Recovered balls, Recovered balls in opponents half, Passes forward (capture angle - 180 degrees), Passes back (capture angle – 180 degrees).

The Operational definition of the variables can be found in the study of Liu et al. (2013b) and <http://optasports.com/news-area/blog-optas-event-definitions.aspx>

3.2.3 Procedure

Match statistics were retrieved from the website of “Whoscored” (www.whoscored.com). The inter-operator reliability of the company’s tracking system (OPTA Client System) used to collect football match statistics was identified as reliable reaching an acceptable level of Kappa, ICC, r and SEM values (Liu et al., 2013). Ethics committee approval of the current study was gained from the local University.

3.2.4 Statistical Analysis

Firstly, the factor analysis using principal components and Varimax rotation was used on the match-related statistics to reduce the dimensions of the study. The Kaiser-Meyer-Olkin measure of sampling adequacy was adequate (0.67) and the anti-image correlation matrix revealed that all variables were above the acceptable level of 0.5. The commonalities analysis showed values below acceptable levels of 0.5 (ranging from 0.20 to 0.47). The principal components obtained in the model accounted for 76.12% of the total variance (see Table 3.1).

Five factors were extracted (eigenvalues above 1) using the value of |0.60| in order to

identify substantial loadings on factors. The extracted factor scores were saved as variables to be used in the data analysis (see Table 3.2). The Factor 1 ("possession" style of play) included the variables ball possession, ball possession in opponent half, ball possession time in the final third of the field, positional attacks, passes, accurate passes, passes forward and back; the Factor 2 is composed by ball possession in own half and set pieces attack (set pieces attack); Factor 3 (counterattacking play) includes counter-attacks, interceptions, interceptions in opponents half, and recovered balls; Factor 4 (transitional play) identified the importance of lost balls and lost balls in opponents half; and Factor 5 (transitional play) including picking up free balls and picking up free balls in opponents half. Secondly, in order to identify the importance of each factor a percentile was done to categorise each factor into ranges of 20 (0-20, 20-40, 40-60, 60-80, and 80-100). Lastly, the influence of team ability (final ranking on the league) on the factors obtained was tested using a linear regression analysis. All the analyses were performed using the statistical software IBM SPSS (version 22.0, Armonk, NY, USA) and statistical significance level was set at $P < 0.05$.

Table 3.1 Eigenvalues for components and total variance explained.

Component	Extraction Sums of Squared								
	Initial Eigenvalues			Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.42	37.10	37.10	7.42	37.10	37.10	6.40	32.00	32.00
2	2.96	14.79	51.90	2.96	14.79	51.90	2.99	14.95	46.95
3	2.25	11.24	63.14	2.25	11.24	63.14	2.49	12.47	59.42
4	2.01	10.04	73.18	2.01	10.04	73.18	2.23	11.17	70.59
5	1.28	6.42	79.60	1.28	6.42	79.60	1.80	9.01	79.60
6	0.80	3.99	83.59						
7	0.75	3.75	87.34						
8	0.57	2.83	90.17						
9	0.47	2.33	92.50						
10	0.43	2.15	94.65						
11	0.27	1.36	96.01						
12	0.23	1.15	97.16						
13	0.20	1.00	98.16						
14	0.15	0.73	98.88						
15	0.09	0.45	99.33						
16	0.07	0.37	99.70						
17	0.06	0.29	99.99						
18	0.00	0.01	100.00						
19	0.00	0.00	100.00						
20	0.00	0.00	100.00						

Table 3.2 Rotated component matrix for the performance indicators.

	Component				
	1	2	3	4	5
BALL POSSESSION, MIN	0.96	-0.04	-0.03	-0.01	0.12
BALL POSSESSION IN OWN HALF	0.58	-0.59	-0.01	0.19	0.09
BALL POSSESSION IN OPP. HALF	0.81	0.45	-0.03	-0.17	0.09
BALL POSSESSION TIME IN THE FINAL THIRD	0.64	0.58	0.01	-0.18	0.15
ATTACKS	0.50	0.60	0.14	0.39	0.26
POSITIONAL ATTACKS	0.63	0.43	-0.13	0.51	0.12
COUNTER-ATTACKS	-0.12	-0.02	0.74	-0.25	0.30
SET PIECES ATTACK	-0.11	0.68	0.02	0.04	0.13
PASSES	0.97	0.01	0.04	0.03	0.03
CROSSES	0.53	0.49	-0.05	-0.15	0.25
INTERCEPTIONS	-0.24	-0.04	0.78	0.18	-0.27
INTERCEPTIONS / IN OPP. HALF	0.11	0.47	0.63	0.16	-0.27
PICKING UP FREE BALLS	0.05	0.11	0.12	0.18	0.87
PICKING UP FREE BALLS - IN OPP. HALF	0.30	0.51	0.04	-0.03	0.65
LOST BALLS	0.06	0.18	0.03	0.92	0.15
LOST BALLS / IN OWN HALF	-0.20	-0.32	-0.07	0.81	-0.04
RECOVERED BALLS	0.21	-0.03	0.82	-0.12	0.32
RECOVERED BALLS / IN OPP. HALF	0.36	0.46	0.44	0.08	0.15
PASSES FORWARD (CAPTURE ANGLE - 180 DEGREES)	0.94	0.07	0.11	0.08	0.07
PASSES BACK (CAPTURE ANGLE - 180 DEGREES)	0.95	-0.07	-0.04	-0.05	-0.02

Table 3.3 Mean for each performance indicator.

Team	Performance indicator																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Guangzhou Evergrande	30,2	952,5	862,3	419,2	103,3	78,1	14,8	10,3	549,8	16,1	44,3	9,4	52,8	21,9	95,8	19,0	46,5	8,8	367,4	182,3
Jiangsu Suning	27,2	836,6	799,2	396,3	97,0	72,0	13,5	11,4	471,7	12,1	49,0	10,8	54,6	20,2	97,1	21,1	43,8	8,2	321,2	150,5
Shanghai SIPG	24,7	785,8	698,7	360,2	100,0	73,2	17,0	10,5	435,9	12,85	52,4	12,4	59,6	21,6	104,3	21,4	48,1	9,4	306,9	129,0
Shanghai Shenhua	24,7	821,8	659,5	361,7	96,7	70,6	15,2	11,0	410,9	13,0	42,6	9,1	57,9	20,5	99,1	22,6	45,0	8,3	285,5	125,4
Beijing Guoan	27,4	849,9	790,5	414,0	97,2	73,3	15,1	9,0	494,9	14,1	48,4	10,8	57,6	21,2	98,5	21,9	45,7	8,9	333,6	161,2
Guangzhou RF	30,0	962,4	841,2	404,8	98,8	77,1	12,7	8,9	535,8	13,8	41,9	8,8	55,7	19,6	96,2	22,0	43,6	8,0	352,2	183,6
Hebei China Fortune	25,6	917,3	624,1	284,7	94,2	72,5	13,1	8,5	473,2	9,3	49,1	9,5	52,1	16,7	100,7	25,4	43,4	6,9	319,4	153,7
Chongqing Lifan	24,9	850,7	645,9	310,8	92,6	69,3	14,6	8,6	423,8	11,7	49,9	8,6	54,8	17,8	98,0	23,6	45,0	7,1	292,2	131,6
Yanbian	25,4	934,5	594,2	281,7	97,2	70,5	17,2	9,4	483,7	8,1	49,9	9,6	63,1	18,7	109,3	29,3	47,7	7,4	324,4	159,2
Liaoning Whowin	22,3	788,5	552,4	276,1	87,5	64,8	14,0	8,7	395,1	8,0	52,4	9,7	58,2	19,2	100,2	27,1	43,8	7,0	281,0	114,1
Tianjin Teda	23,7	783,3	645,1	336,2	100,9	72,6	16,2	11,6	413,9	13,3	52,3	11,7	61,4	22,8	103,4	20,7	46,5	9,1	292,6	121,2
Changchun Yatai	22,4	791,8	555,8	281,4	94,5	69,1	13,9	11,4	381,6	10,2	52,0	10,2	61,2	20,0	107,1	25,2	46,2	7,5	272,1	109,4
Henan Jianye	22,0	680,7	643,2	350,3	98,2	70,7	14,4	13,4	375,0	10,8	48,6	11,2	62,2	21,9	106,7	24,2	45,0	10,1	274,6	100,3
Shandong Luneng	28,0	884,3	803,8	422,1	103,7	78,1	16,0	9,5	485,9	17,7	43,4	9,1	61,5	25,3	105,2	21,7	48,2	9,1	330,0	155,9
Hangzhou Lucheng	24,0	825,6	615,9	300,8	91,3	66,8	15,8	8,6	399,8	9,4	52,0	9,6	58,5	17,5	99,0	24,3	47,1	7,1	282,9	116,8
Shijiazhuang	23,6	821,7	599,7	325,4	94,4	67,9	14,7	11,7	398,6	13,2	44,7	9,3	60,5	21,1	103,7	24,0	42,7	7,5	283,9	114,7

1 = Ball Possession, Min. 2 = Ball Possession in Own Half. 3 = Ball Possession in Opp. Half. 4 = Ball Possession Time in the Final Third of the Field. 5 = Attacks. 6 = Positional Attacks. 7 = Counter-Attacks. 8 = Set Pieces Attacks. 9 = Passes. 10 = Crosses. 11 = Interceptions. 12 = Interceptions in Opponents Half. 13 = Picking Up Free Balls. 14 = Picking Up Free in Opponents Half. 15 = Lost Balls. 16 = Lost Balls in Opp. Half. 17 = Recovered Balls. 18 = Recovered Balls in Opponents Half. 19 = Passes Forward. 20 = Passes Back.

Table 3.4 Team's styles of play according to the playing styles.

Rank.	Team	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
		Possession	Set piece	Counter-attack	Transitional play	
1	Guangzhou Evergrande	↑↑	=	=	=	=
2	Jiangsu Suning	=	=	=	=	=
3	Shanghai SIPG	=	=	=	=	=
4	Shanghai Shenhua	=	=	=	=	=
5	Beijing Guoan	=	=	=	=	=
6	Guangzhou RF	↑↑	=	=	=	=
7	Hebei China Fortune	=	=	=	=	=
8	Chongqing Lifan	=	=	=	=	=
9	Yanbian	=	↓↓	=	=	=
10	Liaoning Whowin	=	=	=	=	=
11	Tianjin Teda	=	=	=	=	=
12	Changchun Yatai	=	=	=	=	=
13	Henan Jianye	↓↓	↑↑	=	=	=
14	Shandong Luneng	=	=	=	=	=
15	Hangzhou Lucheng	=	=	=	=	=
16	Shijiazhuang	=	=	=	=	=

Note. - Abbreviations used indicate the degree of utilization for each playing style: ↓↓: values lower than the the lower quartile 25-0; =: values ranged between quartiles 25-50; ↑↑: values greater than upper quartile 75-100

3.3 Results

The descriptive results for each variable according to the teams were presented in Table 3.3.

The results of the upper and lower quartiles for each factor were presented in Table 3.4, including arrows trying to explain a greater or lower use of this playing style for each team of the Chinese Super League. Competing teams are ordered according to their final classification. The results showed that possession style was more used by Yanbian team.

Lastly, Figure 3.1, 3.2 and 3.3 are presented in order to plot the factors and check the use of each playing style according to the teams. The results of Figure 3.1 (Factor 1 vs Factor 2) suggest that the teams Guangzhou Evergrande, and Guangzhou RF are more focused on Factor 1 with medium values of Factor 2; the team Henan Jianye is centred on Factor 2. Figure 3.2 shows that the team Beijing Guoan is centred on both Factor 1 and 3; and Figure 3.3 shows that the team Hebei China Fortune is focused on Factor 4, the team Shanghai Shenhua on Factor 5, and the team Yanbian perform high in both Factors (4 and 5).

Figure 3.1 Styles of play according to Factor 1 (possession) and Factor 2 (set piece).Figure 2

Figure 3.2 Styles of play according to Factor 1 (possession) and Factor 3 (counter-attack).Figure 3

3.4 Discussion

Describing and measuring the different playing styles that soccer teams can adopt during a match have direct practical applications for coaches and performance analysts when gathering performance data. Consequently, the purpose of the current study was to identify and measure the playing styles in professional soccer. As was argued the use of different performance indicators would allow to obtain higher-order relationships among them; and then a better description and identification of playing patterns that may reflect a specific playing style (Rein & Memmert, 2016). Specifically, the current study has identified five factors from the exploratory factor analysis: Factor 1 ("possession" style of play), Factor 2 (set pieces attack); Factor 3

(counterattacking play) and Factor 4 and 5 (transitional play). The first one, possession style of play (Factor 1) explained the highest percentage of variance and support the previous findings suggesting that top teams prefer to “control” the match by dictating play instead of give the initiative to the opponent (Collet, 2013). In particular, the strategy of “maintaining possession” may involve more slow play with defensive movements, lower risk when passing, and greater emphasis on re-gaining possession relative to teams who might place less importance on this strategy (Hewitt et al., 2016; Lago-Peñas & Dellal, 2010). This playing style is also called indirect play, which is slower than direct play and uses many short passes, while weaknesses in the opposition defense are sought (Lago-Peñas & Dellal, 2010). It was expected that the teams more focused on Factor 1 were technically superior to the other teams preferring another playing styles. Our data supports this notion as the performance indicators that correlated positively with this factor were ball possession, ball possession in opponent half, ball possession time in the final third of the field, positional attacks, passes, accurate passes, passes forward and back. For example, teams that use the possession style (see Table 3.3) performed 10-20% more passes and had 15-20% more possession than those using the set pieces (Factor 2) or the counterattack play (Factor 3). Along these lines, other studies (Lago, 2009; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009) found very similar findings for most of the variables above in successful versus unsuccessful teams in the the Spanish La Liga and the Italian Serie A. It would appear that the teams with the best performance are able to impose and maintain their pattern of play despite the alteration of

situational variables along the match (e.g. the evolving score) and between matches (e.g. playing at home or away).

Factor 2 identifies a playing style based on Set Pieces. Ball possession in own half was the performance indicator that correlated negatively with this factor and suggest the risk of lose the ball in the defensive zone for a team. The available research has identified that between 30% and 40% of goals at the elite level are scored either directly or indirectly from set pieces (Acar et al., 2009; Alcock, 2010; Wright, Atkins, Polman, Jones, & Sargeson, 2011). The analysis of recent performance trends show an increase of set play efficiency (defined as more goals scored from fewer set plays) in men's domestic and international soccer, as well as successful teams are more efficient scoring from set plays (Barreira, Garganta, Guimarães, Machado, & Anguera, 2014; Wallace & Norton, 2014).

Figure 3.3 Styles of play according to Factor 4 and Factor 5 (transitional play).

Factor 3 identifies teams that use the counterattack and a high-pressure defensive playing style. The performance indicators that correlated positively with this factor were interceptions, interceptions in opponents half, recovered balls and number of counterattacks. It has been demonstrated that direct attacks and counterattacks are more effective than elaborate attacks in order to produce a score-box possession or to score goals (Lago-Ballesteros et al., 2012; Tenga, Holme, et al., 2010; Tenga, Ronglan, et al., 2010). However, further analyses reveal that counterattacks were more effective than elaborate attacks when playing against an imbalanced defense (Tenga, Holme, et al., 2010; Tenga, Ronglan, et al., 2010). The counterattacks are more effective than elaborate attacks when playing against an imbalanced rather than a balanced defense

that reduces the surprising effect, since the main objective of counterattacking is to exploit weakness in the opponent's defense (Lago-Ballesteros et al., 2012; Tenga, Holme, et al., 2010; Tenga, Ronglan, et al., 2010) to achieve penetrative passes or open players' penetration. The utilization of a high- or low-pressure playing style is probably notably influenced by the opposing team's style of play.

Factors 4 and 5 define two playing styles based on picking up free balls and Turnovers. Transition periods during soccer matches present good opportunities to increase the probability of success. Offensive speed and outnumbering opposition defenses are key objectives for attacking successfully (Hewitt et al., 2016) while the defensive team must be re-organized rapidly, because poor or slow coordination are related to conceding goals (Lago-Ballesteros et al., 2012). Teams with a speed advantage would exploit this dominance and develop a playing style based on explosive speed by gifted players (Hewitt et al., 2016). The importance of transitions for the course of play has been noted by several authors (Tenga, Holme, et al., 2010; Tenga, Ronglan, et al., 2010; Vogelbein, Nopp, & Hökelmann, 2014). Most goals and risk situations occur during these contexts, and therefore the moment when a team loses possession of the ball is critical in defensive set-ups. Barreira et al. (2014) indicated that direct recovery of the ball in central areas of the field increased attack efficiency and reported that protecting the midfield areas and pressurizing the player with the ball were key factors for improving the overall organization of the defense. In particular, Vogelbein et al. (2014) analysed matches in the German Bundesliga to demonstrate that top teams

recovered the ball quicker after losing it in comparison to lower ranked teams. They also found that the current score influenced the defensive reaction time. Other studies have shown an advantage in recovering ball possession as closer to the goal as possible in order to increase goal scoring opportunities (Fernandez-Navarro et al., 2016; Lago-Ballesteros et al., 2012; Tenga, Holme, et al., 2010; Tenga, Ronglan, et al., 2010). Ball recoveries closer to the attacking goal produced seven times more goals and nineteen times more reaches to the score-box (Tenga, Holme, et al., 2010; Tenga, Ronglan, et al., 2010) compared to ball recoveries in the defensive zones.

With regard to the limitations of the present study, some aspects should be highlighted. Situational variables (e.g. match location, opposition level and the score-line) were not considered and these variables may affect styles of play used by teams. In fact, previous studies have emphasized the importance of accounting for situational variables during the assessment of sport performance (Lago-Peñas, 2012). The importance of these variables is reflected in potential changes in the teams' and players' activities as a response to match situations. More matches, variables and different competitions should be considered to provide conclusive descriptions and measures for playing styles and generalisability of the data. Finally, the combined effects of offensive and defensive tactics and opponent interactions should be included in the future.

3.5 Conclusions

In conclusion, different playing styles (Possession, Set Piece, Counterattack and Transitional Play) and correlated performance indicators were identified in the current study. The selected factors together explained 76.1% of the variance. The current findings may allow coaches and analysts to classify the teams' styles so that playing styles profiles could be created for each teams. Positive or negative scores for the 5 factors would determine how much a team relies on one specific style or combination of these styles. Table 4 presents the teams' attacking and defensive playing styles. For example, Guangzhou Evergrande, Guangzhou RF, Beijing Guoan, Jiangsu Suning and Shandong Luneneg used a ppossession playing style based on ball possession, positional attacks and passes. Conversely, high scores of Shanghai SIPG, Yanbian and Tianjin Teda on Factor 3 define a counterattack style of play due to the teams' high percentage of interceptions, recovered balls and counterattacks. In addition, the values of each factor determine the degree of utilization for each playing style. The identification and understanding of the playing style or pattern of play of teams may have other practical applications, for example, when recruiting players who are capable of playing according to the style of the team (similar technical-tactical level). Furthermore more detailed analysis into the types of training methodologies and drills, and the evaluation of training compared to the strategies and tactics used during competitive scenarios. Existing recommendations suggest that the scouting of upcoming opposition should be carried out under circumstances that are reflective of the conditions under which the future match will occur. However, such procedures are

unlikely to be practical due to time and resource constraints. Consequently, by establishing the impact of particular styles of play on performance, teams and players can be observed, when possible, with appropriate adjustments being made to analyses based on knowledge of such effects. Similarly, post-match assessment of the technical, tactical and physical aspects of performance can be more objective by factoring in the effects of styles of play. Finally, if a performance analyst or a coach has identified that the technical, physical or tactical aspects of performance are adversely influenced by specific playing styles, the plausible causes can be examined and then the match preparation can be focused on reducing such effects.

Tesis Doctoral

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CHAPTER 4

Physical and technical differences between domestic and foreign soccer players according to playing positions in the China Super League

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Chapter 4 Physical and technical differences between domestic and foreign soccer players according to playing positions in the China Super League

4.1 Introduction

Soccer requires players to be competent across a number of physical and technical performance domains (Reilly, 2003). Due to the complex nature of the sport, players utilise their physical and technical skills in different manners during competition (e.g. sprints, high-intensity actions, or changes of direction modified for the match situation) (Bangsbo et al., 2006). In particular, adult male soccer players normally run 9-14 km in total distance during match-play, where high-intensity running (6.5-7.4 m/min) accounts for ~8–10% of the total distance (Bradley, Lago-Penas, Rey, et al., 2014; Di Mascio & Bradley, 2013; Mohr et al., 2003) including sprinting activity of 10-20m over 2-3 seconds (Kawamori, Nosaka, & Newton, 2013). An international elite player performs approximately 1330 activities during a match, including ~220 runs at high speed (2.2–2.7 m/min) (Barros et al., 2007; Di Salvo et al., 2007; Mohr et al., 2003; Rampinini et al., 2007). The physical demands of match-play have been quantified in specific leagues worldwide including the English Premier League (EPL) (Bradley et al., 2009; Di Salvo et al., 2009), Italian Serie A (Mohr et al., 2003; Vigne et al., 2010), Spanish La Liga (Castellano et al., 2011), French Ligue 1 (Carling, 2010), German Bundesliga (Hoppe, Slomka, Baumgart, Weber, & Freiwald, 2015) and the UEFA European Champions League (Bradley, Dellal, Mohr, Castellano, & Wilkie, 2014; Di Salvo et al., 2010). While the modern soccer game is physically demanding for athletes throughout the world, most elite athletes also exhibit proficient technical skills including accurate passing and ball distribution that contribute to

winning matches (Barnes et al., 2014; Bradley et al., 2013; Carmichael et al., 2001; Lago & Martin, 2007; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). For example, an elite soccer player performs 35.6 (± 17.1) passes, with 9.3 (± 5.9) short passes, 19.8 (± 11.3) medium passes and 6.2 (± 4.5) long passes (Barnes et al., 2014; Bradley, Lago-Penas, & Rey, 2014). Therefore, optimization of both physical demands and technical skills of players would enhance match-play and success for teams (Bradley, Lago-Penas, & Rey, 2014; Clemente et al., 2019).

While knowledge about physical and technical demands for European professional players have been identified to assist team success, each playing position has unique requirements and roles during a match that require consideration (Rein & Memmert, 2016). For example, wide midfielders (WM) were reported to cover the greatest distance at high-intensity during match-play compared to other positions (Bradley et al., 2009; Dellal, Wong, Moalla, & Chamari, 2010; Di Salvo et al., 2009). Relative to total distance running during match-play, defenders were reported to cover the greatest amount of high-intensity running with central midfielders (CM) performing the most frequent bouts of running with short recovery (Carling, Le Gall, & Dupont, 2012). Positional differences were also reported for technical performances in soccer with forwards (F) and CM completing more touches per possession ($2.5\text{--}2.7 \pm 0.4\text{--}0.6$), and CM (31.8 ± 7.5) performing and accomplishing more passes (40.8 ± 13.4) compared to F (20.0 ± 5.6) and central defenders (CD, 24.0 ± 11.7) (Redwood-Brown, Bussell, & Singh Bharaj, 2012; Taylor et al., 2004). In addition, the percentage of successful passes was higher for CM (82.5 ± 10.1) than CD (76.2 ± 10.9), F (73.4 ± 11.2) and WM (77.6 ± 11.1). These distinctive differences highlight

the necessity to account for playing positions when examining player's performances, but other factors may also need to be considered, such as country of origin or domesticity (Bush et al., 2015).

Competitions from continents other than Europe (e.g. Asia) have been rarely studied (Velema, 2016). Further, these competitions (e.g. Korea, Japan and China) feature player restrictions that limit the number of foreign players per team (Velema, 2016). In particular, the China Super League (CSL) is unique as it recruits many foreign players (e.g. ageing stars and South American mercenaries) (Vamplew, 2017) each year to improve team quality and success. Subsequently, the Chinese Football Association (CFA) has developed a foreign players' policy for the CSL stating that each team may have 5 foreign, non-goalkeeper players, including a maximum of 4 foreign players from anywhere in the world and 1 player from a country within the Asian Football Confederation (AFC) among the team, with a maximum of 4 foreign players on the field at any one time. Given this specific foreign player policy, one that is more restricted than most other elite competitions (Vamplew, 2017), teams within the CSL may exhibit distinctive performance profiles with differences potentially notable between domestic and foreign players according to playing positions. Thus, the aims of this study were to: 1) discriminate performance between domestic and foreign players according to playing positions; and 2) identify the performance profiles of domestic and foreign players according to the key performance indicators in the CSL. Outcomes from the current research would document the unique performance characteristics of foreign and domestic players within the same competition to assist coaches, managers and performances analysts with player evaluation and development of crucial recruitment criteria.

4.2 Method

4.2.1 Design and Population

This study examined all matches (n=240) played by 16 teams during a balanced schedule of 30 rounds within the CSL during the 2014 season. During each match, players' physical and technical performances were obtained by Amisco Sports Analysis Services and Opta Sportdata, respectively. The movements of outfield players (goalkeepers excluded) were recorded by eight stable and synchronized cameras positioned at the top of the stadia (sampling frequency 25 Hz). Signals and angles obtained by the encoders were sequentially converted into digital data and recorded on six computers for post-match analysis. The validity and reliability of this tracking system has been reported previously and confirmed as good-excellent for the capture process and data accuracy (Bradley et al., 2011). Specifically, acceptable intra-class correlation coefficients (range 0.88-1.00) and standardised typical errors (range 0.00-0.37) were reported for the technical variables using the match-actions coding system (Liu et al., 2013a).

Physical and technical data were collected using a computerized match analysis system with 3468 observations analysed that included domestic (n=2276) and foreign players (n=1192) according to their playing positions (CD= central defender; WD= wide defender; CM= central midfielder; WM= wide midfielder; and F= forward). Specifically, domestic central defenders (DCD=474) and foreign central defenders (FCD=452), domestic wide defenders (DWD=677) and foreign lateral defenders (FWD=61), domestic central midfielders (DCM=578) and foreign central midfielders (FCM=241), domestic wide midfielders (DWM=356) and foreign wide midfielders (FWM=42), and domestic forwards (DF=191) and foreign forwards (FF=396) were

examined. Data from individual performances were only included for outfield players that had completed the entire 90 minutes of matches. Ethical approval for this study was obtained from the appropriate institutional ethics committee with Amisco Pro© supplying the data and granting permission to publish.

4.2.2 Match Performance Variables

The following performance variables for each individual were examined: total distance covered, high-intensity distance (combined distance covered via high-speed running and sprinting ≥ 19.8 km. h⁻¹), number of high-intensity runs/actions, sprint distance (> 25.1 km. h⁻¹), number of sprints, proportion of total distance at a sprinting level (%), number of passes (P) and pass success (P success %), number of forward passes and pass success (FWD P success %), number of shots and shot success (S success %), number of crosses and cross success (C success %), number of aerial challenges and aerial challenge success (AC success %), number of ground challenges and ground challenge success (GC success %), and number of fouls committed. These variables have been well investigated and documented in soccer matches (Lago-Peñas et al., 2010; Lago-Peñas, Lago-Ballesteros, et al., 2011; Liu et al., 2013a; Liu et al., 2015b; Liu, Hopkins, et al., 2016).

4.2.3 Statistical Analysis

Following a preliminary exploration of the data (e.g. normality review using Kolmogorov-Smirnov tests), a discriminant analysis was carried out to identify the physical and technical variables that better discriminated domestic and foreign players

according to each playing position (e.g. CD, WD, CM, WM and F) (Ntoumanis, 2001). Structural coefficients (SC) were used to identify the variables that better differentiated the groups of players (domestic or foreign) with an absolute SC value > 0.30 considered relevant for group discrimination (Tabachnick & Fidell, 2007).

Secondly, a two-step cluster with log-likelihood as the distance measure and Schwartz's Bayesian criterion was performed to classify all domestic and foreign players' performances according to the key variables that discriminated each playing position (e.g. all players were captured in either the best or the worst cluster). This method automatically determines the optimal number of clusters (Tabachnick & Fidell, 2007) with variables ranked based upon the predictor's importance. This procedure provides normalized weights to support the cluster distribution. Next, the clusters were differentiated (based on foreign and domestic players' performances) using a one-way ANOVA and pairwise comparisons with Bonferroni correction. All statistical analyses were conducted using SPSS software (IBM SPSS Statistical of Windows, Version 21.0. Armonk, NY: IBM Corp.) and the level of significance was set at $p < 0.05$.

4.3 Results

Descriptive results of the physical and technical variables for domestic and foreign players categorized by position (e.g. CD, WD, CM, WM, and F) are presented in Tables 4.1- 4.3.

Discriminant functions were identified with all statistically significant and correctly classifying 57.7% of the cases for CD ($\chi^2_{19} = 41.730$; $p = 0.002$), 71.4% of the cases for

WD ($\chi^2_{19}= 48.499$; $p<0.001$), 60.6% of the cases for the CM ($\chi^2_{19}= 52.214$; $p<0.001$), 78.1% of the cases for the WM ($\chi^2_{19}= 60.525$; $p<0.001$) and 68% of the cases for F ($\chi^2_{19}= 93.730$; $p<0.001$).

For CD, domestic players were discriminated from foreign players by more crosses, less total distance, and less aerial and ground challenges (Table 4.1). For WD, domestic players were differentiated from foreign players by less total distance covered and number of passes (Table 4.1). For CM, differences between domestic and foreign players were based upon number of passes, number of forward passes, number of aerial and ground challenges, and ground challenge success (Table 4.2). Differences between domestic and foreign WM were based upon total distance covered, distance covered at high-intensity, number of high-intensity actions, sprint, number of sprints and number of passes (Table 4.2). Lastly, the domestic F was discriminated from foreign F by greater total distance covered, and lower number of shots and shot success (Table 4.3)

Table 4.1 Mean and Standard Deviation (SD) of physical and technical indicators for domestic and foreign Central Defenders and Wide defenders.

Variables	Central defender					Wide defender				
	Domestic		Foreign		SC	Domestic		Foreign		SC
	M	S	M	S		M	S	M	S	
Total distance (m)	9,611	1,006	9,820	793	0.53	10,119	778	10,417	1,083	-0.39
High-Intensity distance (m)	317.2	145.0	319.3	132.8	0.04	490.9	172.9	476.3	208.6	0.09
Number of High-Intensity runs/actions	19.9	8.5	19.9	7.7	0.01	29.6	10.0	28.7	12.1	0.09
Sprint distance (m)	137.2	84.0	135.1	80.6	-0.06	235.0	109.1	214.9	123.6	0.19
Number of sprints	6.8	3.8	6.6	3.5	-0.10	11.0	4.7	10.0	5.3	0.23
Sprint % of Total Distance	1.4	0.8	1.4	0.8	-0.12	2.3	1.0	2.0	1.1	0.30
Number of Passes	28.8	14.8	29.7	15.0	0.15	30.3	15.4	36.6	18.1	-0.43
Pass Success (%)	79.2	13.6	78.5	14.2	-0.12	77.2	13.2	81.0	15.1	-0.30
Number of Forward Passes	12.0	7.1	12.1	7.8	0.05	12.5	7.0	12.8	6.4	-0.04
Forward Pass Success (%)	62.7	23.3	63.0	23.1	0.04	62.3	22.4	65.2	23.9	-0.14
Number of shots	0.5	0.9	0.5	0.9	-0.06	0.5	0.8	0.5	0.8	-0.02
Shot Success (%)	9.1	26.4	12.6	30.9	0.28	10.4	28.5	8.9	27.9	0.06
Number of crosses	0.9	1.7	0.6	1.2	-0.45	1.4	1.8	1.2	1.7	0.14
Cross Success (%)	8.0	21.8	7.8	23.9	-0.02	14.5	28.4	9.5	23.7	0.19
Number of Aerial Challenges (AC)	3.5	2.9	3.9	3.1	0.28	2.8	2.4	3.3	2.8	-0.23
AC Success (%)	51.8	36.8	55.8	35.6	0.26	46.7	38.6	49.7	34.8	-0.08
Number of ground challenges (GC)	3.9	2.5	4.4	2.8	0.44	4.5	2.9	4.8	2.6	-0.11
GC Success (%)	57.8	32.4	59.3	31.4	0.11	57.6	30.1	60.3	28.7	-0.10
Number of fouls committed	1.3	1.2	1.3	1.3	0.02	1.5	1.4	1.6	1.4	-0.07

Note 1: SC > | ± 0.30 |

Table 4.2 Mean and Standard Deviation (SD) physical and technical indicators for domestic and foreign central midfielders and wide midfielders.

Variables	Central midfielder				SC	Wide midfielder				SC
	Domestic		Foreign			Domestic		Foreign		
	M	S	M	S		M	S	M	S	
Total distance (m)	10,545	899.8	10,644	934.1	0.19	10,693	804.3	11,393	655.9	-0.66
High-Intensity distance (m)	400.0	172.8	410.9	165.0	0.11	490.5	182.4	604.3	196.8	-0.46
Number of High-Intensity runs/actions	25.7	10.4	26.5	9.9	0.14	30.6	10.8	37.5	10.5	-0.48
Sprint distance (m)	158.4	98.3	154.3	90.1	-0.08	216.0	108.4	276.1	136.2	-0.40
Number of sprints	7.9	4.4	7.9	4.2	-0.03	10.6	4.8	13.5	5.8	-0.44
Sprint % of Total Distance	1.5	0.9	1.5	0.8	-0.08	2.0	1.0	2.4	1.1	-0.28
Number of Passes	37.0	16.5	43.2	18.4	0.63	36.3	16.1	29.7	14.4	0.31
Pass Success (%)	77.9	11.4	78.2	12.3	0.05	76.2	10.8	71.8	13.9	0.29
Number of Forward Passes	12.4	6.7	14.9	7.8	0.61	11.8	6.7	10.0	6.1	0.21
Forward Pass Success (%)	60.4	21.2	62.4	18.8	0.17	58.4	20.5	54.7	24.2	0.13
Number of shots	1.0	1.3	1.2	1.4	0.26	1.2	1.3	0.8	0.9	0.22
Shot Success (%)	16.5	32.3	18.2	32.2	0.09	21.2	35.2	15.9	33.7	0.11
Number of crosses	2.1	2.8	2.2	2.9	0.07	2.9	3.3	2.6	2.8	0.06
Cross Success (%)	16.5	28.8	16.1	28.3	-0.02	17.8	27.0	14.7	21.5	0.09
Number of Aerial Challenges (AC)	2.6	2.4	3.1	2.8	0.34	2.2	2.0	2.9	2.6	-0.24
AC Success (%)	39.6	38.2	36.9	37.1	-0.12	27.7	34.0	26.8	32.1	0.02
Number of ground challenges (GC)	4.8	2.7	5.5	3.3	0.41	5.2	3.1	5.1	2.8	0.00
GC Success (%)	52.7	28.5	59.5	26.9	0.42	53.9	28.9	54.7	25.7	-0.02
Number of fouls committed	1.7	1.4	1.8	1.5	0.18	1.3	1.3	1.8	1.5	-0.26

Note: SC > | ± 0.30 | .

Table 4.3 Mean and Standard Deviation (SD) of physical and technical indicators for domestic and foreign Forwards.

Variables	Forward				SC
	Domestic		Foreign		
	M	S	M	S	
Total distance (m)	10,452	944	10,031	1,117	-0.44
High-Intensity distance (m)	514.7	215.8	529.7	203.6	0.08
Number of High-Intensity runs/actions	31.5	12.4	32.4	12.0	0.09
Sprint distance (m)	242.8	126.0	253.6	122.2	0.10
Number of sprints	11.5	5.4	12.1	5.4	0.14
Sprint % of Total Distance	2.3	1.1	2.5	1.1	0.20
Number of Passes	28.9	14.4	31.8	13.7	0.24
Pass Success (%)	73.4	12.8	71.6	12.4	-0.16
Number of Forward Passes	9.2	5.8	9.0	5.8	-0.04
Forward Pass Success (%)	54.9	25.2	50.4	24.4	-0.20
Number of shots	1.5	1.6	2.1	1.7	0.40
Shot Success (%)	21.5	34.3	31.1	35.2	0.31
Number of crosses	1.8	2.5	1.8	2.3	0.02
Cross Success (%)	15.1	28.2	15.4	29.4	0.01
Number of Aerial Challenges (AC)	4.1	3.5	5.2	4.8	0.27
AC Success (%)	39.6	35.2	36.9	32.4	-0.09
Number of ground challenges (GC)	4.7	2.7	4.9	2.8	0.09
GC Success (%)	54.3	28.9	48.0	29.7	-0.24
Number of fouls committed	1.5	1.4	1.7	1.4	0.10

Note: SC > | ± 0.30 | .

The two-step cluster analysis classified players into best and worst categories (according to their performances) using the key performance indicators that discriminated domestic and foreign players in the discriminant analyses. This analytical model was significant for each playing position (Table 4.4); the best foreign players exhibited greater values for most variables per playing position (e.g. CD, WD, CM, WM and F) compared to the worst foreign and best/worst domestic players (Table 4.4). Lastly, the best domestic players were better than the worst foreign players for total distance (CD, WD, WM and F), high-intensity (WM), number of high-intensity actions (WM), sprint (WM), number of sprint (WM), sprint of total distance (WM), number of passes (CM and WM), number of forward passes (CM),

number of ground challenges (CD), number of shots and shot success (F, Table 4.4).

Table 4.4 Descriptive results (mean±SD) for the key performance indicators that differentiate players according to playing position.

Variable	Position	Best foreign	Worst foreign	Best domestic	Worst domestic	F	P
Distance	CD	9,832±778c	9,744±886c	10,122±885	9,266±934abc	42.607	<0.001
	WD	10,974±755	9,800±1063ac	10,528±654a	9,646±628ac	117.067	<0.001
	WM	11,722±478	10,766±818a	10,975±679a	10,470±826ac	30.445	<0.001
	F	10,127±1098	9,907±1,132c	10,580±930a	10,366±946a	8.773	<0.001
High-Intensity distance (m)	WM	717±124	377±82ac	648±127a	365±107ac	211.447	<0.001
Number of High-Intensity runs/actions	WM	43.8±6.1	25.0±4.4ac	39.6±7.8a	23.4±6.7ac	187.935	<0.001
Sprint distance (m)	WM	345±106	137±61ac	306±88	144±57ac	166.443	<0.001
Number of sprints	WM	16.6±4.1	7.2±2.8ac	14.7±3.7a	7.3±2.6ac	197.052	<0.001
Sprint % of Total Distance	WD	2.7±0.8	1.1±0.6ac	2.6±1.0	2.0±0.9abc	35.542	<0.001
Number of Passes	WD	27.2±14.4bc	47.0±16.2	38.9±13.6b	20.3±10.5abc	142.456	<0.001
	CM	58.4±14.0	30.6±10.5ac	52.6±12.4a	27.8±10.6ac	335.730	<0.001
Number of Forward Passes	WM	29.4±7.6	30.4±23.0	32.9±12.5	39.0±18.1ac	6.710	<0.001
	CM	21.1±6.2	9.7±4.3ac	18.7±5.4a	8.7±4.2ac	316.208	<0.001
Number of crosses	CD	0.2±0.4bc	3.1±1.6	1.7±2.2b	0.3±0.6bc	166.617	<0.001
Number of shots	F	3.1±1.6	0.9±0.9ac	2.9±1.4	0.5±0.7ac	173.224	<0.001
Shot Success (%)		55.2±29.3	0.0±0.0ac	53.9±34.7	0.0±0.0ac	304.303	<0.001
Number of Aerial Challenges (AC)	CM	3.1±2.3	3.0±3.1	2.2±2.8ab	2.8±2.5c	4.751	<0.001
Number of ground challenges (GC)	CD	4.4±2.8c	4.3±3.2c	5.8±2.4	2.6±1.7abc	65.271	<0.001
	CM	6.7±3.3	4.5±2.9a	4.5±2.3a	5.0±2.9a	16.374	<0.001
GC Success (%)	CM	58.0±23.6	60.8±29.3	56.4±28.3	50.5±28.4b	5.557	0.001

Note: a: p<0.05 significant difference vs best foreign; b: p<0.05 significant difference vs worst foreign; c: p<0.05 significant difference vs best domestic; CD: central defender; WD: wide defender; CM: central midfielder; F: Forward

4.4 Discussion

The aim of this study was to examine the performance characteristics of domestic and foreign players based upon playing position in the CSL. Results from the current study indicated that there were important differences in physical and technical performances between Chinese (domestic) and foreign (non-Chinese) players. Notably, non-Chinese players performed more passes, shots, and aerial and ground challenges when compared with Chinese players. While fewer physical performance

differences were observed between groups, non-Chinese WD and WM covered greater distances than their counterparts, and Chinese F covered greater distances than their foreign counterparts.

To our knowledge, several studies have analysed the player performance differences between different leagues (James, Mellalieu, & Hollely, 2002b) but only Bush, Archer, Barnes, Hogg, and Bradley (2017) have analyzed the effect of player domesticity on match performance in elite soccer. Bush et al. (2017) reported that match performance characteristics (distances covered and passing variables) in the EPL were similar between domestic (United Kingdom born) and foreign (non-United Kingdom born) populations. These results contrast with that of the current study where match performance differences between domestic and foreign players in the CSL was considerable, and greater compared to the EPL, anecdotally the league with the best players in the world. The difference within the CSL likely highlights a great reliance of teams on foreign players of higher quality to enhance team success. It should be noted that while better quality foreign players are often sought after by teams within the CSL, many recruit ageing elite players from European competitions and South American mercenaries (Vamplew, 2017) with the quality of foreign players variable. While potentially not the best of the elite soccer players in the world, these foreign players still exhibited greater abilities than current Chinese players, highlighting a clear difference between players of different nationalities and/or competitions. Interestingly, Bush et al. (2017) demonstrated that the United Kingdom players covered more high-intensity running distance and performed less passes compared with the non-United Kingdom players in 2006/07; however, by 2012/13, both groups covered similar distances and passing performance during matches. As the authors

suggested, it appeared that each group of players assisted the other in the evolution of abilities over time (Bush et al., 2017). This performance evolution could be a benefit of recruiting foreign players by CSL teams with an aim to enhance abilities of domestic players. A future longitudinal study of match performance characteristics for both Chinese and non-Chinese players within the CSL could clarify the evolution of domestic player's ability (Bush et al., 2017) and confirm the benefits of a foreign player policy within the league.

One interesting finding of the current study was the existence of significant differences between domestic and foreign players for all playing positions studied (CD, WD, CM, WD, and F). For example, the non-Chinese WM covered greater distances and worked at greater intensities than domestic players while the non-Chinese WD were more involved in the offensive activities of the team than their Chinese counterparts. These disparities may be due to unique differences of styles of play during formative years between foreign and domestic players in their respective countries (Vamplew, 2017). Further, the differences could indicate a more collective style of play for foreign players in their home countries while domestic players reflected a minor tactical focus. According to this argument and given that goal scoring is the ultimate objective of the play, teams within the CSL may therefore have to recruit the best players in offensive playing positions to cover the limitations of domestic squads including possible less technical skills.

While differences were noted between domestic and foreign players for most positions, the balance of foreign WD (DWD=678 and FWD=60) and WM (DWM=356 and FWM=42) compared to domestic players was very low compared to

the other playing positions. This imbalance indicated that Chinese clubs focused on recruitment of foreign players in other playing positions such as F, CD and CM, positions associated with success (Velema, 2016). It should be noted that the recruitment policy of CSL limits the number of foreign players with clubs likely recruiting these players to key positions related to scoring (F), decision-making and passing skills (CM), and defensive actions (CD). Moreover, this recruitment focus may indicate that Chinese players overall are still developing important skills such as passing effectiveness, tactical creativity, offensive talent or decision-making (Velema, 2016).

A novel aspect of the current study was the identification of good (best) and bad (worst) domestic and foreign players based upon match performances within the CSL. These results have identified the key performance indicators of domestic and foreign players to allow coaches and teams to confirm the importance or value of players while also assisting in the potential recruitment of players for future seasons within a competition employing a restrictive foreign policy. To our knowledge, no studies have classified domestic and foreign players into categories based on their match performance characteristics. Given that the number of foreign players per competition has increased dramatically in recent years around the world (Bromberger, 2013), this approach may very useful to assess players' current worth and expectations for future monetary investment.

The findings of this study have an important practical application in terms of player recruitment given that the benchmark requirements for modern CSL players per each position have been identified. The benchmarks could assist in identifying soccer

players who align with a team's current player configuration and playing style. Moreover, this data could be used to objectively evaluate the performance of current players for player management processes and negotiations (McKenna, Cowan, Stevenson, & Baker, 2018).

The current study has produced novel results in terms of performance characteristics for domestic and foreign players, per playing position, in the CSL. However, some limitations should be noted. The present study examined performances over a single season. A longitudinal study of match performance characteristics of Chinese and non-Chinese players in the CSL may clarify the evolution of player ability, particularly that of domestic players. In addition, some physical and technical variables examined may be influenced by tactical or playing styles (e.g. playing formation) (Bradley et al., 2011; Folgado, Gonçalves, & Sampaio, 2018) which were not accounted for in the current analysis. Discrimination between the non-Chinese players who had played in the CSL for consecutive seasons and those in their first season (e.g. repeated measures design) may clarify the influence of playing styles. For example, non-Chinese players may perform at a greater level in their first year within the CSL compared to after playing a number of seasons in the CSL. Future studies may clarify the impact of playing style on match performances by foreign and/or domestic players. Additionally, whether the differences between domestic and foreign players based upon technical and physical will directly influence the team ranking (end-of-season) or team success during a complete season (Abbott, Brownlee, Harper, Naughton, & Clifford, 2018; Yang, Leicht, Lago, & Gomez, 2018) remains to be determined.

4.5 Conclusions

In conclusion, important differences were noted between a large sample of Chinese (domestic) and non-Chinese (foreign) players in the CSL in terms of physical and technical performance indicators for various playing positions. These dissimilarities will help coaching staff to account for diverse playing styles based upon country of origin and develop training to enhance individual technical and physical skills of players for team success over a season. Further, categorization (e.g. good or bad) of foreign players was possible based upon match performances and could be used to substantiate player worth. The current study provided match performance profiles for coaches, performance analysts and managers to improve the recruitment process and team's composition of domestic and foreign players.

CHAPTER 5
Technical and physical
performances of Chinese Super
League soccer players differ
according to their status and
position

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Chapter 5 Technical and physical performances of Chinese Super League soccer players differ according to their status and position

5.1 Introduction

Soccer is a very competitive and demanding sport, which requires from players the high level of technical, tactical and physical performance, as well as well-developed psychological capacities (Bangsbo et al., 2006). According to the observations available in soccer literature, both physical (e.g. high-intensity running) and technical (e.g. shooting and passing skills, rhythm, accuracy and success of players actions, etc.) performances progressively decline over the course of 90 min (Di Salvo et al., 2009; Mohr et al., 2003; Rampinini et al., 2011). In order to minimize the effects of fatigue, coaches usually manage well-timed substitutions to replace the underperforming or injury players (Bradley, Lago-Penas, & Rey, 2014). From a tactical perspective, most substitutions are made with the intention of improving the team performance. This is especially important in soccer, where coaches have limited opportunities to directly impact the course of the match (Gomez et al., 2016). An effective substitution strategy may enhance the efficacy of a tactical plan, optimize physical responses and thereby contribute to a positive outcome (Bradley, Lago-Penas, & Rey, 2014; Carling, 2010). Despite the substitution is an important tool for influencing team performance, especially when there is a need to change the current match status, limited research regarding this action has been found (Del Corral et al., 2008; Myers, 2012).

From the physical perspective, the movement demands of whole-match soccer players has been extensively investigated (Akenhead, Hayes, Thompson, & French, 2013; Barnes et al., 2014; Russell et al., 2016), however much fewer data exist regarding the responses of substitutes entering the field of play.

Bradley, Lago-Penas, and Rey (2014) highlight that substitutes can be deemed effective from a work-rate perspective, when the players entered the field are able to perform at equivalent or higher work-rates than the player who was replaced, or others players remaining on the pitch.

The available research on the performance analysis in soccer, generally limits to explore match-related differences between starters and substitutes of five outfield positions analyzed together (Buchheit, Mendez-Villanueva, Simpson, & Bourdon, 2010; Carling, 2010; Di Salvo et al., 2010). Most of studies on substitutions in soccer have either analyzed all playing positions together or only considered two positions - midfielders and attackers (Carling, Espie, Le Gall, Bloomfield, & Jullien, 2010; Mohr et al., 2003). Moreover, to the best of our knowledge, the special literature has not yet provided any information regarding differences between the technical performance indicators of substitutes and those players, who completing the full match (Bradley, Lago-Penas, & Rey, 2014; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). Recently, Bradley and colleagues (2014) suggested to focus on quantification of physical and technical indicators of substitutes taking into account their positions and considering multiple time periods. This analysis could provide coaches with additional information about the specific playing positions demands and contribute to the optimization of team management decisions during the match. Thus, the aim of

this study was to evaluate and compare the match performance of three groups of players of Chinese Super League: starters, substitutes and whole-match players, across different playing positions. The following paired comparison has been made: starters vs. substitutes, whole-match players vs. substitutes and intra comparison: starters vs. substitutes. This study intends to provide the match performance profiles for starters and substitutes that may contribute to a more objective assessment of individual performance and can help coaches to improve the management of substitutions during the match.

5.2Method

5.2.1 Sample

The study sample consisted of three groups of players: 1) starters (n=4,794), 2) substitutes - players who replace the starters (n=1,208) and 3) whole-match players (n=3,505) - players who completed the full 90 min of match. All groups included players of five outfield positions: central defender, full-back, central midfielder, wide midfielder, and forward. (Table 5.1- 5.5).

The study was organized in three stages. In the first stage the starters (n=4,794) were compared with substitutes (n=1,208); in the second stage the whole-match players (n=3,505) were compared with substitutes (n=1,208), and in the third stage the player's intra comparison - starters (n=258) vs. substitutes (n=258) was conducted (the same player who played in starting line-up was compared to himself as a substitute). Only outfield players who had completed the period from 5 minutes to the whole time of match were included in the sample.

5.2.2 Data Collection

Data were collected from 240 matches of Chinese Super League played by 16 teams in 30 rounds with a balanced schedule in the 2014 season. Players' activity was recorded by a semi-automatic computerized player tracking system Amisco Sports Analysis Services and Opta Sportdata. Both systems have been validated to verify capture process and accuracy of the data (Liu et al., 2013a; Zubillaga et al., 2007).

The following technical performance variables were considered for the analysis by Opta Sportdata: passes and passes success, forward passes (FWD passes) and forward passes success (FWD passes success), shots, shots success, crosses, crosses success, aerial challenges, aerial challenges success, ground challenges, ground challenges success and fouls committed. The following variables of physical activity were analyzed by Amisco Sports Analysis Services: total distance, high-intensity distance (it consisted of the combined distance covered in high-speed running and sprinting, high-speed running and sprinting $\geq 19.8 \text{ km} \cdot \text{h}^{-1}$), high-intensity number of actions, sprint ($> 25.1 \text{ km} \cdot \text{h}^{-1}$), sprint number of actions and sprint % of distance (the percentage of sprints in the total distance covered). All the variables were validated in the previous research (Castellano et al., 2012; Gai et al., 2018; Lago-Peñas et al., 2010; Lago-Peñas, Lago-Ballesteros, et al., 2011; Liu et al., 2013a; Liu et al., 2015b; Liu, Hopkins, et al., 2016; Yang et al., 2018).

5.2.3 Statistical Analysis

After the exploratory analysis of the data and testing of normality assumption using Kolmogorov-Smirnov test, the independent-sample t-test and paired sample t-test were carried out to identify those variables of physical activity and technical

performance variables between starters and substitutes of different playing positions (e.g. central defender, full-back, central midfielder, wide midfielder and forward) according to three comparisons (Ntoumanis, 2001). The Cohen's *d* effect size (ES) measure was used to estimate the magnitude of the difference (Cohen, 1988). After the calculation of Cohen's *d* measures, its range values were interpreted as follows: very small=0.01, small=0.20, medium=0.50, large=0.80, very large=1.20 and huge=2.0 (Cohen, 1988; Sawilowsky, 2009).

The Statistical Package for the Social Sciences software (SPSS version 21.0, Chicago, IL, USA) was used for statistical calculations. The significance's level was set at $p < 0.05$.

5.3 Results

Descriptive statistics - mean, (M) and standard deviation (SD) - for physical activity and technical performance variables of starters and substitutes of five outfield positions (central defenders and full-backs, central and wide midfielders, and forwards) are presented in Tables 5.1- 5.5, respectively.

Independent-Measures Analysis

For the comparisons of two groups (starters vs. substitutes and whole-match players vs. substitutes) independent-measure analysis has been used. The results of comparative analysis regarding physical performance of substitutes, starters and whole-match players showed that substitutes of both two above mentioned groups

were superior in all physical activity variables (total distance running, high-intensity, number of high-intensity, sprint, number of sprint, and sprint % of distance).

The results of comparative analysis of technical performance of substitutes and starters are presented in Table 5.1. These results demonstrated that substitute central defenders (CDs) made significantly more passes shots, ground challenges and also committed more fouls than the starters. At the same time substitute CDs were less successful in passes and ground challenges.

The substitute FBs made more shots than the starter FBs, but they had less success in FWD passes, excepted crosses. The starter FBs made more crosses than substitutes FBs. On the contrary, the comparison between the whole-match FBs and substitute FBs demonstrated that whole-match FBs made less crosses than the substitutes (table 5.2).

When compared to starter CMs the substitute CMs made more passes, FWD passes, shots, crosses, aerial challenges, ground challenges and also committed more fouls. However, substitute CMs were less successful in passes, FWD passes, aerial challenges and ground challenges (Table 5.3).

When compared to starter WMs the substitute WMs performed more passes, shots, aerial challenges, ground challenges and committed more fouls, but they were less successful in FWD passes (Table 5.4).

The substitute Fs performed more passes, shots, crosses, aerial challenges, ground

challenges and committed more fouls, while they demonstrated worse results in FWD passes success and ground challenges success (Table 5.5).

Repeated-Measures Analysis

For the intra comparisons of starters to substitutes the Repeated-Measures Analysis has been used. The results of comparative analysis showed that there were no significant differences between starter CDs and substitute CDs (Table 5.1). The substitute FBs were less successful than the starter FBs in ground challenges (Table 5.2). The substitute CMs made more passes, shots, aerial challenges, ground challenges and committed more fouls (Table 5.3). The substitute WMs performed more passes than the starter WMs (Table 5.4). The substitute Fs performed more passes, shots, aerial challenges, ground challenges and committed more fouls than the starter Fs (Table 5.5).

Table 5.1 Descriptive statistics (mean±SD and effect size) and comparison by t-test of differences between central defenders of different groups (substitutes, starters and whole-match players).

Variables	Starters vs. Substitutes		Whole-match vs. Substitutes				Intra: Starters vs. Substitutes					
	(n=1,050)	(n=95)			(n=931)	(n=95)			(n=258)	(n=258).		
	Means ± SD		Sig	ES	Means ± SD		Sig	ES	Means ± SD		Sig	ES
Total Distance	102.25±10.67	112.89±16.36	<.001***	0.77	101.93±10.13	112.89±16.36	<.001***	0.81	104.15±8.71	108.11±20.56	.297	0.25
High-intensity	3.40±1.51	5.07±3.48	<.001***	0.62	3.35±1.47	5.07±3.48	<.001***	0.64	3.52±0.91	4.34±2.53	.059	0.43
High-intensity Number	0.21±0.09	0.32±0.21	<.001***	0.68	0.21±0.09	0.32±0.21	<.001***	0.68	0.22±0.06	0.27±0.16	.050	0.41
Sprint	1.46±0.89	2.23±2.32	<.001***	0.44	1.43±0.87	2.23±2.32	.001**	0.46	1.49±0.43	1.87±1.43	.105	0.36
Sprint Number	0.07±0.04	0.11±0.09	<.001***	0.57	0.07±0.04	0.11±0.09	<.001***	0.57	0.07±0.02	0.10±0.07	.075	0.58
Sprint % of Distance	0.01±0.01	0.02±.0.02	<.001***	0.63	0.01±0.01	0.02±0.02	.005**	0.63	0.01±0.00	0.02±0.01	.247	1.35
Passes Number	0.32±0.18	0.52±0.49	<.001***	0.54	0.31±0.16	0.52±0.49	<.001***	0.58	0.35±0.09	0.52±0.38	.025*	0.62
Passes Success	0.79±0.14	0.71±0.23	.001**	0.42	0.79±0.14	0.71±0.23	.001**	0.42	0.80±0.04	0.71±0.15	.005**	0.82
FWD Passes	0.13±0.08	0.16±0.15	.076	0.25	0.13±0.09	0.16±0.15	.056	0.24	0.13±0.04	0.15±0.11	.454	0.24
FWD Passes Success	0.62±0.24	0.49±0.36	.001**	0.42	0.63±0.23	0.49±0.36	<.001***	0.46	0.63±0.08	0.48±0.27	.007**	0.75
Shots	0.01±0.01	0.03±0.03	<.001***	0.90	0.01±0.01	0.03±0.05	<.001***	0.55	0.01±0.01	0.02±0.03	.003**	0.45
Shots Success	0.31±0.42	0.34±0.40	.679	0.07	0.30±0.42	0.34±0.40	.627	0.10	0.17±0.26	0.45±0.39	.016*	0.84
Crosses	0.01±0.02	0.02±0.04	.013*	0.32	0.01±0.02	0.02±0.04	.010*	0.32	0.01±0.01	0.02±0.03	.057	0.45
Crosses Success	0.16±0.41	0.14±0.32	.846	0.05	0.14±0.29	0.14±0.32	.975	0.00	0.16±0.14	0.08±0.16	.085	0.53
Aerial Challenges	0.04±0.03	0.07±0.09	.001**	0.45	0.03±0.03	0.07±0.09	.001**	0.60	0.04±0.02	0.07±0.06	.006**	0.67
Aerial Challenges Success	0.56±0.36	0.40±0.38	.001**	0.43	0.56±0.35	0.40±0.38	.001**	0.44	0.56±0.11	0.41±0.33	.016*	0.61
Ground Challenges	0.04±0.03	0.09±0.11	<.001***	0.62	0.04±0.02	0.09±0.11	<.001***	0.63	0.05±0.02	0.08±0.08	.030*	0.51
Ground Challenges Success	0.59±0.32	0.50±0.40	.026*	0.25	0.59±0.31	0.49±0.40	.022*	0.28	0.58±0.13	0.49±0.30	.165	0.39
Fouls Committed	0.01±0.02	0.04±0.05	<.001***	0.79	0.01±0.01	0.04±0.05	<.001***	0.74	0.02±0.01	0.03±0.03	.009**	0.45

Note: Significance was set: P* < 0.05, P** < 0.01, P*** < 0.001

Table 5.2 Descriptive statistics (mean±SD and effect size) and comparison by t-test of differences between full-backs of different groups (substitutes, starters and whole-match players).

Variables	Starters vs. Substitutes				Whole-match vs. Substitutes				Intra :Starters vs. Substitutes			
	(n=891)	(n=108)			(n=743)	(n=108)			(n=32)	(n=32)		
	Means ± SD		Sig	ES	Means ± SD		Sig	ES	Means ± SD		Sig	ES
Total Distance	107.58±10.91	115.63±18.78	<.001***	0.52	106.70±10.57	115.63±18.78	<.001***	0.59	109.46±7.08	115.67±15.14	.012*	0.53
High-intensity	5.22±1.98	7.75±5.14	<.001***	0.65	5.16±1.90	7.75±5.14	<.001***	0.67	5.32±1.71	7.70±4.36	.001**	0.53
High-intensity Number	0.32±0.11	0.45±0.26	<.001***	0.65	0.31±0.11	0.45±0.26	<.001***	0.70	0.32±0.09	0.44±0.22	.001**	0.71
Sprint	2.48±1.23	3.64±2.72	<.001***	0.55	2.46±1.18	3.64±2.72	<.001***	0.56	2.50±1.09	3.74±2.65	.001**	0.61
Sprint Number	0.12±0.05	0.17±0.11	<.001***	0.59	0.11±0.05	0.17±0.11	<.001***	0.70	0.12±0.05	0.17±0.10	.001**	0.63
Sprint % of Distance	0.02±0.01	0.03±0.02	<.001***	0.63	0.02±0.01	0.03±0.02	<.001***	0.63	0.02±0.01	0.03±0.02	.003**	0.63
Passes Number	0.35±0.23	0.44±0.34	.008**	0.31	0.32±0.17	0.44±0.34	.001**	0.45	0.36±0.14	0.45±0.23	.022*	0.47
Passes Success	0.78±0.13	0.69±0.26	.001**	0.44	0.77±0.13	0.69±0.26	.001**	0.39	0.78±0.05	0.69±0.16	.004**	0.76
FWD Passes	0.13±0.09	0.14±0.12	.707	0.04	0.13±0.07	0.14±0.12	.399	0.10	0.14±0.04	0.15±0.10	.468	0.13
FWD Passes Success	0.62±0.23	0.48±0.35	<.001***	0.47	0.63±0.22	0.48±0.35	<.001***	0.51	0.59±0.14	0.51±0.27	.089	0.37
Shots	0.01±0.01	0.03±0.05	<.001***	0.55	0.00±0.01	0.03±0.05	<.001***	0.70	0.01±0.01	0.03±0.04	.001**	0.69
Shots Success	0.28±0.41	0.40±0.41	.098	0.29	0.30±0.42	0.40±0.41	.175	0.24	0.19±0.19	0.48±0.34	.002**	1.05
Crosses	0.02±0.02	0.01±0.02	.022*	0.14	0.02±0.02	0.04±0.08	.012*	0.34	0.02±0.02	0.03±0.06	.252	0.22
Crosses Success	0.20±0.31	0.23±0.38	.419	0.61	0.20±0.31	0.23±0.38	.422	0.10	0.17±0.11	0.22±0.30	.374	0.22
Aerial Challenges	0.03±0.03	0.06±0.10	.003**	0.41	0.03±0.03	0.06±0.10	.002**	0.41	0.03±0.01	0.06±0.07	.001**	0.60
Aerial Challenges Success	0.48±0.38	0.38±0.42	.014*	0.25	0.49±0.38	0.38±0.42	.008**	0.27	0.42±0.20	0.39±0.33	.558	0.11
Ground Challenges	0.05±0.03	0.08±0.09	.001**	0.45	0.05±0.03	0.08±0.09	<.001***	0.45	0.05±0.02	0.08±0.06	.006**	0.67
Ground Challenges Success	0.59±0.30	0.46±0.40	.040*	0.37	0.59±0.29	0.46±0.40	.004**	0.37	0.62±0.16	0.41±0.29	<.001***	0.90
Fouls Committed	0.02±0.01	0.02±0.03	.019*	0.29	0.02±0.01	0.02±0.04	.010*	0.33	0.02±0.02	0.03±0.03	.011*	0.39

Note: Significance was set: P* < 0.05, P** < 0.01, P*** < 0.001

Table 5.3 Descriptive statistics (mean±SD and effect size) and comparison by t-test of differences between central midfielders of different groups (substitutes, starters and whole-match players).

Variables	Starters vs. Substitutes				Whole-match vs. Substitutes				Intra :Starters vs. Substitutes			
	(n=1,174)	(n=299)			(n=825)	(n=299)			(n=40)	(n=40)		
	Means ± SD		Sig	ES	Means ± SD		Sig	ES	Means ± SD		Sig	ES
Total Distance	112.19±10.67	122.37±13.23	<.001***	0.85	111.01±10.27	122.37±13.23	<.001***	0.96	113.73±11.94	120.63±10.55	<.001***	0.61
High-intensity	4.35±1.93	7.04±3.87	<.001***	0.88	4.24±1.80	7.04±3.87	<.001***	0.93	4.59±1.60	6.43±2.93	<.001***	0.78
High-intensity Number	0.28±0.12	0.45±0.24	<.001***	0.90	0.27±0.11	0.45±0.24	<.001***	0.96	0.30±0.10	0.41±0.17	<.001***	0.79
Sprint	1.70±1.10	2.96±2.45	<.001***	0.66	1.65±1.01	2.96±2.45	<.001***	0.70	1.79±0.91	2.70±1.75	<.001***	0.65
Sprint Number	0.09±0.05	0.15±0.11	<.001***	0.70	0.08±0.05	0.15±0.11	<.001***	0.82	0.09±0.04	0.13±0.08	<.001***	0.63
Sprint % of Distance	0.02±0.01	0.02±0.02	<.001***	0.51	0.01±0.01	0.02±0.02	<.001***	0.63	0.02±0.01	0.02±0.01	<.001***	0.60
Passes Number	0.43±0.24	0.65±0.51	<.001***	0.55	0.41±0.18	0.65±0.51	<.001***	0.63	0.44±0.13	0.63±0.29	<.001***	0.85
Passes Success	0.78±0.12	0.72±0.19	<.001***	0.38	0.78±0.12	0.72±0.19	<.001***	0.63	0.77±0.07	0.72±0.10	.002**	0.58
FWD Passes	0.14±0.10	0.18±0.18	<.001***	0.27	0.14±0.07	0.18±0.18	<.001***	0.29	0.14±0.05	0.18±0.10	.005**	0.51
FWD Passes Success	0.60±0.21	0.49±0.34	<.001***	0.39	0.61±0.21	0.49±0.34	<.001***	0.42	0.60±0.11	0.49±0.23	.001**	0.61
Shots	0.01±0.02	0.04±0.07	<.001***	0.58	0.01±0.01	0.04±0.07	<.001***	0.60	0.01±0.01	0.04±0.03	<.001***	1.34
Shots Success	0.30±0.38	0.32±0.40	.633	0.05	0.30±0.38	0.32±0.40	.593	0.10	0.31±0.21	0.32±0.33	.879	0.04
Crosses	0.02±0.03	0.05±0.08	.000***	0.50	0.02±0.03	0.05±0.08	<.001***	0.50	0.03±0.02	0.05±0.06	.001**	0.45
Crosses Success	0.21±0.31	0.19±0.32	.548	0.06	0.21±0.31	0.19±0.32	.533	0.10	0.20±0.16	0.18±0.20	.430	0.11
Aerial Challenges	0.03±0.03	0.08±0.11	<.001***	0.62	0.03±0.03	0.08±0.11	<.001***	0.62	0.03±0.01	0.08±0.07	<.001***	1.00
Aerial Challenges Success	0.38±0.38	0.27±0.35	<.001***	0.30	0.40±0.38	0.27±0.35	<.001***	0.36	0.37±0.18	0.28±0.25	.022*	0.41
Ground Challenges	0.06±0.04	0.10±0.10	<.001***	0.53	0.05±0.03	0.10±0.10	<.001***	0.68	0.06±0.02	0.10±0.06	<.001***	0.89
Ground Challenges Success	0.54±0.29	0.45±0.38	<.001***	0.27	0.55±0.28	0.45±0.38	<.001***	0.30	0.52±0.16	0.48±0.22	.232	0.21
Fouls Committed	0.02±0.02	0.04±0.05	<.001***	0.53	0.02±0.02	0.04±0.05	<.001***	0.53	0.02±0.01	0.03±0.03	<.001***	0.45

Note: Significance was set: P* < 0.05, P** < 0.01, P*** < 0.001

Table 5.4 Descriptive statistics (mean±SD and effect size) and comparison by t-test of differences between wild midfielders of different groups (substitutes, starters and whole-match players).

Variables	Starters vs. Substitutes				Whole-match vs. Substitutes				Intra :Starters vs. Substitutes			
	(n=700)	(n=293)	Sig	ES	(n=408)	(n=293)	Sig	ES	(n=67)	(n=67)	Sig	ES
	Means ± SD				Means ± SD				Means ± SD			
Total Distance	114.10±9.20	121.55±13.82	<.001***	0.63	112.92±8.75	121.55±13.82	<.001***	0.75	115.21±7.65	120.68±8.79	<.001***	0.66
High-intensity	5.70±2.18	8.22±3.96	<.001***	0.79	5.30±2.00	8.22±3.96	<.001***	0.93	5.97±1.97	7.72±2.72	<.001***	0.74
High-intensity Number	0.35±0.13	0.51±0.24	<.001***	0.83	0.33±0.12	0.51±0.24	<.001***	0.95	0.37±0.11	0.48±0.16	<.001***	0.80
Sprint	2.56±1.35	3.80±2.62	<.001***	0.59	2.36±1.21	3.80±2.62	<.001***	0.71	2.68±1.21	3.49±1.65	<.002**	0.56
Sprint Number	0.12±0.06	0.18±0.12	<.001***	0.63	0.11±0.05	0.18±0.12	<.001***	0.82	0.13±0.05	0.17±0.08	.001**	0.60
Sprint % of Distance	0.02±0.01	0.03±0.02	<.001***	0.63	0.02±0.01	0.03±0.02	<.001***	0.63	0.02±0.01	0.03±0.01	.006**	1.00
Passes Number	0.40±0.22	0.54±0.48	<.001***	0.37	0.37±0.17	0.54±0.48	<.001***	0.47	0.37±0.12	0.49±0.18	<.001***	0.78
Passes Success	0.76±0.12	0.76±0.19	.852	0.01	0.76±0.11	0.76±0.19	.908	0.01	0.75±0.09	0.74±0.13	.810	0.09
FWD Passes	0.12±0.08	0.14±0.19	.085	0.14	0.12±0.07	0.14±0.19	.079	0.14	0.11±0.04	0.13±0.06	.016*	0.39
FWD Passes Success	0.56±0.24	0.50±0.36	.004**	0.20	0.58±0.21	0.50±0.36	<.001***	0.27	0.54±0.15	0.50±0.22	.183	0.21
Shots	0.01±0.02	0.03±0.04	<.001***	0.63	0.01±0.01	0.03±0.04	<.001***	0.69	0.012±0.01	0.02±0.02	.001**	0.51
Shots Success	0.32±0.40	0.38±0.42	.138	0.15	0.34±0.40	0.38±0.42	.404	0.10	0.23±0.18	0.36±0.33	.039*	0.49
Crosses	0.03±0.04	0.04±0.08	.005**	0.16	0.03±0.03	0.04±0.08	.002**	0.17	0.03±0.02	0.04±0.04	.005**	0.32
Crosses Success	0.18±0.27	0.21±0.33	.340	0.10	0.20±0.28	0.21±0.33	.813	0.03	0.15±0.14	0.22±0.23	.142	0.37
Aerial Challenges	0.03±0.02	0.05±0.07	<.001***	0.39	0.02±0.02	0.04±0.07	<.001***	0.37	0.03±0.01	0.05±0.04	.001**	0.69
Aerial Challenges Success	0.29±0.35	0.24±0.38	.077	0.14	0.28±0.33	0.24±0.38	.162	0.11	0.27±0.19	0.23±0.26	.273	0.18
Ground Challenges	0.06±0.05	0.09±0.09	<.001***	0.41	0.05±0.03	0.09±0.09	<.001***	0.60	0.06±0.02	0.08±0.05	.012*	0.53
Ground Challenges Success	0.52±0.28	0.48±0.40	.081	0.12	0.54±0.28	0.48±0.40	.029*	0.17	0.505±0.13	0.497±0.24	.828	0.04
Fouls Committed	0.02±0.02	0.03±0.05	<.001***	0.26	0.01±0.01	0.03±0.05	<.001***	0.55	0.02±0.01	0.04±0.04	.003**	0.69

Note: Significance was set: P* < 0.05, P** < 0.01, P*** < 0.001

Table 5.5 Descriptive statistics (mean±SD and effect size) and comparison by t-test of differences between forwards of different groups (substitutes, starters and whole-match players).

Variables	Starters vs. Substitutes				Whole-match vs. Substitutes				Intra :Starters vs. Substitutes			
	(n=979)	(n=413)			(n=598)	(n=413)			(n=70)	(n=70)		
	Means ± SD		Sig	ES	Means ± SD		Sig	ES	Means ± SD		Sig	ES
Total Distance	108.01±11.39	115.25±15.96	<.001***	0.52	106.76±11.45	115.25±15.96	<.001***	0.61	108.76±8.68	113.29±11.62	<.001***	0.44
High-intensity	5.71±2.25	7.29±3.95	<.001***	0.49	5.52±2.19	7.29±3.95	<.001***	0.55	5.70±1.69	6.86±2.49	<.001***	0.55
High-intensity Number	0.35±0.13	0.44±0.23	<.001***	0.48	0.34±0.13	0.44±0.23	<.001***	0.54	0.35±0.10	0.42±0.14	<.001***	0.58
Sprint	2.76±1.40	3.52±2.70	<.001***	0.35	2.64±1.30	3.52±2.70	<.001***	0.42	2.71±1.07	3.25±1.67	.003**	0.39
Sprint Number	0.13±0.06	0.17±0.12	<.001***	0.42	0.13±0.06	0.17±0.12	<.001***	0.42	0.13±0.04	0.15±0.07	.002**	0.35
Sprint % of Distance	0.03±0.01	0.03±0.02	<.001***	0.25	0.02±0.01	0.03±0.02	<.001***	0.63	0.02±0.01	0.03±0.01	.027*	1.00
Passes Number	0.36±0.20	0.49±0.45	<.001***	0.37	0.32±0.15	0.49±0.45	<.001***	0.51	0.35±0.10	0.46±0.24	<.001***	0.60
Passes Success	0.72±0.13	0.68±0.23	.004**	0.21	0.72±0.12	0.68±0.23	.001**	0.22	0.71±0.08	0.69±0.15	.419	0.17
FWD Passes	0.10±0.08	0.13±0.19	.002**	0.20	0.01±0.06	0.13±0.19	<.001***	0.85	0.10±0.04	0.13±0.08	.016*	0.47
FWD Passes Success	0.51±0.26	0.43±0.37	<.001***	0.25	0.52±0.25	0.43±0.37	<.001***	0.29	0.48±0.16	0.44±0.24	.280	0.20
Shots	0.02±0.02	0.04±0.06	<.001***	0.45	0.02±0.02	0.04±0.06	<.001***	0.45	0.02±0.01	0.04±0.03	<.001***	0.90
Shots Success	0.36±0.37	0.40±0.42	.276	0.10	0.37±0.36	0.40±0.42	.357	0.15	0.33±0.19	0.36±0.27	.472	0.13
Crosses	0.02±0.03	0.04±0.07	<.001***	0.37	0.02±0.03	0.04±0.07	<.001***	0.37	0.02±0.02	0.04±0.04	.001**	0.63
Crosses Success	0.17±0.30	0.13±0.29	.029*	0.14	0.17±0.30	0.13±0.29	.058	0.14	0.17±0.12	0.13±0.18	.122	0.26
Aerial Challenges	0.05±0.05	0.09±0.11	<.001***	0.47	0.05±0.05	0.09±0.11	<.001***	0.47	0.05±0.03	0.08±0.06	<.001***	0.63
Aerial Challenges Success	0.37±0.33	0.34±0.37	.140	0.09	0.38±0.33	0.34±0.37	.068	0.11	0.38±0.17	0.30±0.22	.012*	0.41
Ground Challenges	0.05±0.03	0.09±0.10	<.001***	0.54	0.05±0.03	0.09±0.10	<.001***	0.54	0.05±0.02	0.08±0.06	<.001***	0.67
Ground Challenges Success	0.49±0.30	0.39±0.39	<.001***	0.29	0.50±0.30	0.39±0.39	<.001***	0.32	0.47±0.16	0.39±0.21	.012*	0.43
Fouls Committed	0.02±0.02	0.04±0.06	<.001***	0.45	0.02±0.01	0.04±0.06	<.001***	0.46	0.02±0.01	0.04±0.04	<.001***	0.69

Note: Significance was set: P* < 0.05, P** < 0.01, P*** < 0.001

5.4 Discussion

The current results confirmed the differences in match performance profiles of starter and substitute players across different playing positions. The majority of previous research has analyzed the physical performance of substitutions in soccer (Bradley & Noakes, 2013; Carling et al., 2010; Mohr et al., 2003). To the best of our knowledge this is the first study to evaluate the match performance of three groups of players - starters, substitutes and whole-match players, as well as to perform intra comparison of the players, while starters or substitutes, in the Asian league (CSL). The findings of this analysis emphasize some noteworthy trends.

Regarding physical activity of players, the results of the current study are in line with the previous study conducted in the English Premier League (EPL), which also showed that the substitutes performed greater work-rate (total distance covered, intensity of displacement, etc.) than the starters (Bradley, Lago-Penas, & Rey, 2014). Similarly, the substitutes covered greater distance with high-intensity running than the replaced players during the equivalent time period (Krustrup et al., 2003), and observed that substitute midfielders covered 34% more distance in high-intensity running during the second half than the midfielders they replaced. Meanwhile, with respect to the influence of playing position, Bradley, Lago-Penas, and Rey (2014) reported that substitute central defenders covered more total distance running than starters, whilst substitute central defenders and full-backs completed more sprinting than starters. Furthermore, Carling et al. (2010) reported that no significant difference were identified in work-rate of either forward or midfielder substitutes compared to the players they replaced (starters). These results are in contrast with the findings of the current study and probably can be explained by the fact that the majority of

substitutions in the CSL were mainly due to fatigue reasons rather than tactical purposes. In fact, the substitutions may be the only way for coaches to reduce the effect of fatigue or change team's tactic during match play (Bradley, Lago-Penas, & Rey, 2014).

According to previous research, technical performance variables have been found to predict the team success more accurately than physical variables (Carling, 2013; Castellano et al., 2012). More specifically, number of shots, shots on target (shot success), number of passes and pass completion rates (passes success) were found being associated with the team success (Castellano et al., 2012; Collet, 2013; Hughes & Franks, 2005; Lago-Ballesteros et al., 2012; Lago-Peñas, Lago-Ballesteros, et al., 2011). Amongst those technical variables, passing is not only considered as an important variable, but it also reflects the players' technical skills during match play (Bradley, Lago-Penas, & Rey, 2014; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). The results of the current study suggest that substitutes were more productive than starters in the quantity of technical actions (e.g. number of passes, shots, aerial and ground challenges, etc.). These results are linked with findings of previous research, which reported that players decreased their movements with the ball and the total number of passes as a result of fatigue (Carling et al., 2009). At the same time, Reilly, Drust, and Clarke (2008) found no differences between passing-completion rates of substitutes versus players completing the entire match (whole-match) or those they replaced. The current study contradicts the results of previous studies by demonstrating that whole-match players revealed higher quality of technical actions (e.g. passes success, FWD passes success etc.). As it was mentioned above, the quality of technical-tactical performance of substitutes was not so effective

as of the starting players, indirectly confirming the trend reported in the study of Pratas and colleagues (2016), who found that team offensive performance did not improve after making substitutions in the case of a tied score (0-0) (Pratas, Volossovitch, & Carita, 2016). The impact of substitutes on the course of the game is very specific and related to the coach's tactics for the match, situational factors, injuries and outfield positions of replaced players and substitutes. All these factors, and specially the playing positions, need to be considered in the analysis of substitutions effects on the team performance (Bloomfield et al., 2007). The current study is the first to analyze the match performance in the CSL comparing starters and substitutes with consideration of their playing positions.

Some of limitations of this study need to be considered in the future research. Firstly, the further research should explore whether the situational factors (match location, match status and teams quality) influence the individual match performance of three groups of players – starters, substitutes and whole-game players. Secondly, the intra comparison (starters vs. substitutes) needs to provide larger sample size and enable to investigate the impact of substitutes according to specific positions. Finally, the current study examined the data collected over just one season within the same soccer league, while an examination of variables across multiple seasons and/or leagues might ensure the greater applicability of our findings in elite soccer.

5.5 Conclusion

Coaches often use substitutions to improve the team performance and influence the match status. Regarding a technical performance the current study demonstrated that substitutes make more number of actions than starters, but the efficacy of their actions

is lower. Concerning a physical activity, substitutes performed greater work-rate than starters. The current finding shows that substitutes influence more players' physical performances than technical performances during a match play in the CSL. Our findings demonstrated that from physical perspective substitutions seem to be effective, but its influence on the technical performance and match outcome still need to be established. Therefore, results from current study provide coaches with new information regarding substitutes' performance profiles per position, which can be integrated into overall coaching strategy helping to optimize coaches' decisions and improve team performance in the match play.

CHAPTER 6

***Technical and tactical performance
differences according to player's
nationality and playing position in
the Chinese Super League***

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Chapter 6 Technical and tactical performance differences according to player's nationality and playing position in the Chinese Super League

6.1 Introduction

Performance analysis in soccer is in constant evolution due to the more and more detailed information obtained using semi-automated computerized tracking systems, which allow to register variables regarding physical, technical and tactical performances during competitions and to analyze them according to different factors, such as playing positions or contextual factors (Bradley et al., 2011; Carling et al., 2005; Di Salvo et al., 2007; Lago-Ballesteros et al., 2012). Along this way, the available research on soccer players is widely focused on analyzing their physical performance or a combination of physical and some technical parameters (Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009; Russell et al., 2013). Modern soccer is physically demanding, meanwhile players still need to be highly proficient in their technical and tactical skills to perform at elite level. Some of technical and tactical skills are considered to be the more relevant for players' performance, such as passing skills and the tactical awareness. Due to players accommodate these skills to the teams' styles of play and match constraints, the teams can improve their performance and then have an effect to the match outcome (Barnes et al., 2014; Bradley et al., 2013; Dellal et al., 2011). The technical actions have been found to be the best predictors of success in soccer compared to using those researches that only accounted for physical parameters (Bush et al., 2015; Castellano et al., 2012; Lago-Peñas et al., 2010; Lago-Peñas, Lago-Ballesteros, et al., 2011; Rampinini, Impellizzeri, Castagna, Coutts,

& Wisloff, 2009; Russell et al., 2013). The importance of technical-tactical performance during the match play has been confirmed by several researches, who pointed out that performance profiling is improved when considering a wide range of technical-tactical performances taking into account the playing position (Bush et al., 2015; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). Rampinini et al. (2009) verified that passing performance in the English Premier League (EPL) was worse than in other European Leagues. Players in the EPL performed both fewer total passes and fewer successful passes compared to players in the Italian Serie A (Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). In addition, more long passes were observed in the EPL compared with the Italian and Spanish Leagues (Barnes et al., 2014; Dellal et al., 2011; Rampinini, Impellizzeri, Castagna, Coutts, & Wisloff, 2009). Therefore, technical parameters of match are strongly influenced by playing styles, formations and location on the pitch (Bradley et al., 2011), and these factors should be controlled for during data interpretation.

The previous studies examined the nature of individual player's tactical behavior within the playing positions of defender, midfield and forward. The results suggested differences in technical and spatial demands according to player's role on the field (Taylor et al., 2004). In line with these findings, Taylor et al. (2004) hypothesized that player's tactical behavior would provide an indication of specific responsibilities or roles (target man, defensive, midfielder, etc.). Meanwhile, studies of the technical behaviors reported that defender, midfielder and forward performed the greatest number of clearances, dribbles and shots, respectively (Reilly & Williams, 2003; Taylor et al., 2004).

The inclusion of the Bosman's Law (named after the Belgian player Jean-Marc Bosman, who took his case to the European Court of Justice) gave clubs the right to hire European players without restrictions. As a consequence, the labor market of soccer teams became truly global. Therefore, since 1995 the number of foreign players in the five main European soccer leagues - England, Spain, Germany, Italy, and France (hereinafter referred to as the Big Five) - has increased substantially. On average, foreign players accounted for around 43% of all players in 2009. The highest percentage of foreign players (59%) was found in the English Premier League. For top clubs, like Arsenal FC (93 %) or Inter Milan (92 %t), the percentage of foreign players was even higher (Maderer, Holtbrügge, & Schuster, 2014). However, this data is not available for some competitions, some of the least investigated soccer leagues are the Asian ones (e.g., EPL, La Liga, Serie A, etc.) (Gai et al., 2018; Velema, 2016). The restrictions of those competitions (e.g., China, etc.) limit the numbers of foreign players for each team (Gai et al., 2018; Velema, 2016). Particularly in China Super League (CSL) most of teams each year recruit ageing important players to improve team's quality and increase the probability of success (Vamplew, 2017). Due to this phenomenon the Chinese Football Association (CFA) has developed a foreign players policy to restrain the numbers of players for each team (5 foreign non-goalkeeper players, including a maximum of 4 foreign players from anywhere in the world and 1 player from a country within the Asian Football Confederation (AFC) (Gai et al., 2018). This recruitment process might explain those differences verified between performances of national and foreign players, with the former showing lower levels of technical and tactical skills compared with national ones (Gai et al., 2018). Up to now, only one study (Gai et al. (2018) has investigated the match profiles related to physical and some technical-tactical performances in the CSL. However, the

technical-tactical aspects accounted for were passes, shots, crosses, aerial challenges, ground challenges and committed fouls. These indicators only reflect a reduced area of technical and tactical behavior displayed by players during competitions. Therefore, the analysis of specific match demands (e.g. related to goal scoring, passing, attacking, and defending) are required to have specific performance profiling of national and foreign players in the CSL. Thus, the aim of the current study was to examine and compare a wide range of match technical-tactical performances of domestic and foreign players taking into account their playing positions in the CSL.

6.2 Method

6.2.1 Sample

The study sample consisted of 2,364 observations of technical-tactical actions of domestic (n=1,081) and foreign players (n=1,283) performed in 240 matches from the 2016 CSL season. More specifically, the observations included technical-tactical actions of domestic (n=538) and foreign defenders (n=419), domestic (n=439) and foreign midfielders (n=345), and domestic (DFs=92) and foreign forwards (n=531). Only data regarding individual performance of outfield players, who had completed the entire 90 min of match, were included in the study. All groups included players of different outfield positions (Table 6.2).

6.2.2 Variables

Forty nine indicators (performances related to match events: actions and variables) were included in the current study and selected in according with the available literature (Castellano et al., 2012; Fernandez-Navarro et al., 2016; Lago-Ballesteros et al., 2012; Liu et al., 2013b; Tenga, Holme, et al., 2010; Tenga, Ronglan, et al., 2010).

The operational definitions of these variables (Liu et al., 2013b) are as followed in Table 6.1.

Table 6.1 Selected match performance statistics. 图表 1

Groups	Variables
Variables related to goal scoring	Goals=G _s ; Assists=A _s ; Playing in Scoring Attacks=P in SAs GMs= Grave Mistake; Foul Suffered=FS; Passes=P _s ; Passes Accurate=P _s A; % of Accurate Passes=% of APs; Extra Attacking and Key Passes=EA and KPs; Extra Attacking and Key Passes-Accurate=EA and KPs-A; Crosses=C _s ; Crosses-Accurate=Crosses-A; Crosses-Accurate, %=Crosses-A, %; Challenges=C _s ; Challenges/Won=C _s /W; % of Challenges Won=% of C _s W; Attacking Challenges=AC _s ; Attacking Challenges Successful=AC _s S; Challenges in Attack/Won= C _s in A/W,%;Air Challenges=Air C _s ; Air Challenges/Won= Air C _s /W; Air Challenges,%=Air C _s ,%;Dribbles=D _s ; Dribbles Successful=D _s S; % of Successful Dribbles= % of SDs; Picking up Free Balls= P up FBs; Picking up Free Balls in Opp. Half= P up FBs in Opp. Half; Lost Balls=LBs; Lost Balls/in Own Half=LBs/in Own Half; Passes Forward (Capture Angle-180 Degrees)=P _s F; Passes Back (Capture Angle-180 Degrees)= P _s B; Passes to the Left (Capture Angle-180 Degrees)=P _s to the L; Passes to the Right (Capture Angle-180 Degrees)= P _s to the R; Passes Forward Accurate(Capture Angle-180 Degrees)=P _s FA; Passes Back Accurate (Capture Angle-180 Degrees)=P _s BA; Passes to the Left Accurate (Capture Angle-180 Degrees)=P _s to the LA; Passes to the Right Accurate (Capture Angle-180 Degrees)=P _s to the RA
Variables related to passing and attack organization	YCs=Yellow Cards; Fouls=F _s ; Defensive Challenges=DC _s ; Defensive Challenges Successful=DC _s S; Challenges in Defense/Won,%=C _s in D/W, %; Tackle=T _s ; Tackle Successful=TsS; % of Tackle Won=% of TsW; Interceptions=I _s ; Interceptions/In Opp. Half=I _s /in Opp. Half; Recovery Balls=RBs; Recovery Balls/in Opp. Half=RBs/in Opp. Half
Variables related to defense	

6.2.3 Date source and reliability

The data were collected from 240 matches of CSL played by 16 teams in 30 rounds with a balanced schedule in the 2016 season. All match performance data were gathered by the tracking system OPTA Sports Data. The process of validation of OPTA Client System revealed an acceptable inter-operator reliability (intra-class correlation coefficients ranged from 0.88 to 1.00 and standardized typical error varied from 0.00 to 0.37 when using the system to code match actions of individual outfield players) (Liu et al., 2013b).

6.2.4 Statistical analysis

After the exploratory analysis of the data and testing of normality assumption using

Kolmogorov-Smirnov test, the individual match-to-match variation was expressed by the means of each match action or event (Bush et al., 2015; Spencer, Losnegard, Hallen, & Hopkins, 2014). The differences of means of technical-tactical performances were established by playing position lines: (a) domestic and foreign defensive line formed by defenders; (b) domestic and foreign midfielders offensive and defensive line formed by midfielders; (c) domestic and foreign offensive line formed by forwards. In each group national and foreign players were compared separately. The comparisons of performance profile were performed using the spreadsheet of (Batterham & Hopkins, 2006). Therefore, magnitude-based inferences (MBI) were employed and evaluated by the smallest worthwhile difference. The smallest worthwhile difference was calculated by 0.2 times the standardization estimated from between-subject standard deviation. For the comparison of player related to variation of match performance, there was only one independent inference (means), so the 90% confidence intervals were used to make the inferences. While for the comparison on the match performance of players, there were 49 independent inferences (49 independence-related match actions and events). To reduce the inflation of Type 1 error, only clear differences with 99% confidence intervals were evaluated. The magnitudes of clear differences were assessed as follows: <0.20 - trivial; 0.20–0.60 - small; 0.61–1.20 - moderate; 1.21–2.0 - large; >2.0 - very large (Batterham & Hopkins, 2006). Differences were deemed to be clear if the confidence intervals for the difference in the means did not include both of positive and negative values ($\pm 0.2 \times \text{standardization}$) (Hopkins, Marshall, Batterham, & Hanin, 2009).

6.3 Results

The results of descriptive statistics regarding the technical-tactical variables and

comparison between domestic and foreign players by playing position lines (defenders, midfielders and forward) are presented in the Tables 6.2 (a, b). The comparison of defenders showed the significant differences between domestic and foreign players in match performance profiles. Worthwhile, foreign players made more than domestic players defending related actions (e.g. Cs/W and % of CsW) (Figure 1a). Regarding a comparison of midfielders, foreign players made more than domestic players passing and attack organizing actions (e.g. ACs, ACsS, Ds and DsS), but made less in defending related actions (DCs) (Figure 1b). Concerning a comparison of forwards, foreign players made more passes than domestic players and performed more attack organizing actions (e.g. Cs, ACs, ACsS, and Ds) (Figure 6.1 c).

Table 6.2 (a) Basic descriptors (variables related to goal scoring and defense) related to players' nationalities (domestic and foreign) (mean and standard deviation) and playing positions are as follow: defender, midfielder and forward.

Variables	Defender		Midfielder		Forward	
	Domestic (n=538)	Foreign (n=419)	Domestic (n=439)	Foreign (n=345)	Domestic (n=92)	Foreign (n=531)
	Means±SD	Means±SD	Means±SD	Means±SD	Means±SD	Means±SD
Gs	0.02±0.14	0.06±0.26	0.06±0.24	0.14±0.39	0.25±0.57	0.36±0.61
As	0.03±0.16	0.02±0.15	0.09±0.3	0.11±0.35	0.21±0.48	0.18±0.43
P in SAs	0.1±0.32	0.13±0.36	0.28±0.59	0.39±0.68	0.58±0.87	0.72±0.88
YCs	0.19±0.39	0.17±0.38	0.19±0.4	0.13±0.34	0.1±0.3	0.14±0.35
Fs	1.2±1.16	1.29±1.21	1.51±1.29	1.38±1.34	1.41±1.46	1.81±1.54
DCs	10.34±4.4	11.05±4.46	8.93±4.56	8.31±4.42	4.72±3.5	4.11±2.83
DCsS	6.18±3.1	7.19±3.24	4.21±2.84	4.26±3.03	2.05±2.25	1.49±1.6
Cs in D/W, %	0.59±0.19	0.65±0.16	0.45±0.21	0.49±0.22	0.38±0.3	0.34±0.3
Ts	2.95±2.03	2.74±1.85	4.17±2.53	3.66±2.43	2.37±2.38	1.91±1.84
TsS	1.73±1.49	1.7±1.32	1.93±1.59	1.87±1.61	1.03±1.38	0.85±1.05
% of TsW	0.53±0.36	0.58±0.37	0.44±0.3	0.47±0.33	0.39±0.39	0.35±0.39
Is	6.65±3.1	7.1±3.17	4.79±2.95	5.07±3.38	2.54±1.96	1.95±1.78
Is / in Opp. Half	0.48±0.77	0.48±0.78	1.48±1.46	1.46±1.5	1.02±1.1	0.91±1.07
RBs	6±2.73	6.85±3.06	4.15±2.71	4.81±3.2	1.73±1.64	1.39±1.56
RBs/ in Opp. Half	0.56±0.79	0.63±0.84	1.29±1.31	1.3±1.26	0.55±0.82	0.59±0.83

Note: Goals=G_s; Assists=A_s; Playing in Scoring Attacks=P in SAs; Defensive Challenges=DCs; Defensive Challenges Successful= DCsS; Challenges in Defense/Won, %= Cs in D/W, %; Tackle=T_s; Tackle Successful=T_sS; % of Tackle Won= % of TsW; Interceptions=I_s; Interceptions/In Opp. Half=I_s/in Opp. Half; Recovery Balls=RBs;

Recovery Balls/in Opp. Half=RBs/in Opp. Half.

Table 6.2 (b). Basic descriptors (variables related to passing and organization) related to players' nationalities (domestic and foreign) (mean and standard deviation) and playing positions are as follow: defender, midfielder and forward.

Variables	Defender		Midfielder		Forward	
	Domestic (n=538)	Foreign (n=419)	Domestic (n=439)	Foreign (n=345)	Domestic (n=92)	Foreign (n=531)
	Means±SD	Means±SD	Means±SD	Means±SD	Means±SD	Means±SD
GMs	0.67±0.91	0.71±0.86	0.28±0.57	0.27±0.63	0.15±0.57	0.07±0.26
FS	0.74±0.89	0.82±0.99	1.23±1.24	1.81±1.71	1.77±1.8	2.2±1.59
Ps	39.7±14.92	41.7±15.22	50.86±18.2	56.0±17.78	30.95±10.35	31.92±12.53
PsA	32.7±14.35	33.6±14.64	42.5±17.18	46.7±16.41	23.67±8.67	24.53±11.06
% of APs	0.8±0.12	0.79±0.1	0.82±0.1	0.83±0.09	0.77±0.09	0.76±0.1
EA and KPs	0.37±0.77	0.41±0.73	1.37±1.54	2.2±2.2	1.89±1.86	2.28±2.02
EA and KPs - A	0.17±0.46	0.19±0.46	0.61±0.93	1.07±1.32	1.03±1.21	1.14±1.28
Crosses	0.26±0.77	0.2±0.6	1.01±1.47	0.9±1.38	1.17±1.32	1.21±1.53
Crosses - A	0.09±0.35	0.04±0.22	0.33±0.71	0.33±0.72	0.32±0.53	0.32±0.63
Crosses - A, %	0.06±0.21	0.03±0.16	0.15±0.31	0.15±0.31	0.16±0.29	0.15±0.3
Cs	12.5±5.09	13.77±5.34	14.74±5.72	17.1±7.31	18.1±6.69	23.3±8.22
Cs/W	7.47±3.57	8.91±3.72	7.21±3.55	9.28±4.45	7.64±3.74	9.84±4.58
% of CsW	0.6±0.18	0.65±0.14	0.49±0.16	0.54±0.16	0.42±0.14	0.42±0.13
ACs	2.16±2.01	2.72±2.32	5.8±3.84	8.79±6.68	13.38±6.93	19.18±7.74
ACsS	1.29±1.38	1.72±1.57	3±2.13	5.02±3.83	5.59±3.51	8.35±4.29
Cs in A/W, %	0.47±0.41	0.56±0.39	0.53±0.28	0.56±0.27	0.41±0.17	0.44±0.14
Air Cs	5.49±3.37	6.44±3.74	3.92±2.89	4.39±3.79	6.18±4.3	8.73±6.33
Air Cs/W	3.35±2.44	4.24±2.77	1.88±1.8	2.28±2.33	2.38±2.16	3.48±3.45
Air Cs, %	0.6±0.29	0.66±0.24	0.45±0.33	0.48±0.33	0.36±0.23	0.36±0.24
Ds	0.59±1.07	0.67±1.02	1.93±1.77	3.82±3.44	3.27±2.3	5.12±3.62
DsS	0.38±0.74	0.52±0.86	1.23±1.33	2.7±2.63	1.82±1.58	2.99±2.6
% of SDs	0.23±0.4	0.32±0.45	0.49±0.41	0.58±0.37	0.48±0.35	0.54±0.3
P up FBs	6.19±2.88	6.8±3.09	6.26±3.11	6.65±3.27	3.27±2.42	3.25±2.36
P up FBs in Opp. Half	0.96±1.19	0.94±1.17	2.79±1.99	3.08±2.14	1.91±1.58	2.14±1.68
LBs	5.25±2.96	5.84±3.35	8.68±4.12	10.11±6.18	13.65±5.37	15.58±5.24
L Bs/in Own Half	2.37±1.75	2.32±1.82	2.26±1.73	2.27±1.65	1.7±1.57	1.95±1.66
PsF	31.95±11.72	34.55±12.11	34.1±13.38	39±13.9	16.92±7.67	17.15±8.19
PsB	7.84±5.42	7.19±4.79	16.76±7.54	17.02±7.84	14.02±5.66	14.77±6.55
Ps to the L	19.57±9.73	21.61±9.68	27.03±10.99	27.59±9.57	16.58±7.41	15.25±7.44
Ps to the R	20.22±9.88	20.13±9.38	23.83±10.87	28.43±11.01	14.37±6.6	16.68±7.98
PsFA	25.22±11.08	26.81±11.48	26.78±12.44	30.96±12.9	11.25±5.65	11.48±6.52
PsBA	7.54±5.31	6.88±4.7	15.79±7.27	15.77±7.34	12.42±5.45	13.05±6.26
Ps to the LA	16.24±9.29	17.5±8.96	22.74±10.14	23.1±8.96	12.57±6.01	11.68±6.09
Ps to the RA	16.52±8.94	16.19±8.88	19.84±9.93	23.63±9.9	11.11±4.8	12.84±7.16

Note: Grave Mistakes=GMs; YCs=Yellow Cards; Fouls=Fs; Foul Suffered=FS; Passes=Ps; Passes Accurate=PsA; % of Accurate Passes=% of APs; Extra Attacking and Key Passes=EA and KPs; Extra Attacking and Key

Passes-Accurate=EA and KPs-A; Crosses=Cs; Crosses-Accurate=Crosses-A; Crosses-Accurate,%=Crosses-A,%;
Challenges=Cs; Challenges/Won=Cs/W; % of Challenges Won= % of CsW; Attacking Challenges=ACs; Attacking
Challenges Successful=ACsS; Challenges in Attack/Won= Cs in A/W,%; Air Challenges=Air Cs; Air
Challenges/Won= Air Cs/W; Air Challenges,%=Air Cs,%; Dribbles=Ds; Dribbles Successful= DsS; % of
Successful Dribbles= % of SDs; Picking up Free Balls= P up FBs; Picking up Free Balls in Opp. Half= P up FBs
in Opp. Half; Lost Balls=LBs; Lost Balls/in Own Half=LBs/in Own Half; Passes Forward (Capture Angle-180
Degrees)=PsF; Passes Back (Capture Angle-180 Degrees)= PsB; Passes to the Left (Capture Angle-180
Degrees)=Ps to the L; Passes to the Right (Capture Angle-180 Degrees)= Ps to the R; Passes Forward
Accurate(Capture Angle-180 Degrees)=PsFA; Passes Back Accurate (Capture Angle-180 Degrees)=PsBA; Passes
to the Left Accurate (Capture Angle-180 Degrees)=Ps to the LA; Passes to the Right Accurate (Capture Angle-180
Degrees)=Ps to the RA.

Defender

Figure 6.1(a). Effect sizes [90% CI] of differences between the mean counts of domestic and foreign players. When the bars of one variable crossed the negative and positive smallest worthwhile change threshold at the same time, the effect was unclear. Asterisks indicate the likelihood for the magnitude of the true differences between mean as follows: *possible; **likely; ***very likely; ****most likely. Asterisks located in the trivial area denote for trivial differences.

Midfielder

Figure 6.1(b). Effect sizes [90% CI] of differences in the mean counts between domestic and foreign players, when bars of one variable crossed the negative and positive smallest worthwhile change threshold in the meantime, the effect was unclear. Asterisks indicate the likelihood for the magnitude of the true differences in mean as follows: *possible; **likely; ***very likely; ****most likely. Asterisks located in the trivial area denote for trivial differences.

Forward

Figure 6.1(c). Effect sizes [90% CI] of differences in the mean counts between domestic and foreign players, when bars of one variable crossed the negative and positive smallest worthwhile change threshold in the meantime, the effect was unclear. Asterisks indicate the likelihood for the magnitude of the true differences in mean as follows: *possible; **likely; ***very likely; ****most likely. Asterisks located in the trivial area denote for trivial differences.

6.4 Discussion

The aim of current study was to examine and compare the technical and tactical performance of domestic and foreign players (using a wide range of KPI) in the CSL according their outfield positions (defender, midfielder and forward). The individual match performances have been analyzed in different leagues (James, Mellalieu, & Hollely, 2002a), but only one study (Bush et al., 2017) has analyzed the effect of player's nationality on match performance in elite soccer. Bush et al. (2017) reported that technical data revealed just trivial or small differences between UK and non UK players in the English Premier League (EPL), but authors did not considerate in their comparative analysis the outfield positions of players.

Our study also suggests from trivial to small differences between domestic (Chinese) and foreign (non-Chinese) players on the defender position, and from small to moderate differences for both midfielder and forward positions. These results are in line with the previous study of Redwood-Brown et al. (2012), whom reported that the technical-tactical performances were influenced by playing positions; for instance, central midfielders and full backs completed more passes compared to other positions (Redwood-Brown, Bussell, & Bharaj, 2012).

According to Liu, Gomez, Goncalves, and Sampaio (2016) the central defenders and full-backs from strong teams of the Spanish Football League (La Liga) made more attack- and passing related actions, but less defense related actions than their counterparts from weak teams. The current results showed that foreign defenders (central defenders and full-backs) not only performed better in defense related actions (DCsS and Cs in D/W, %), but also in passing and attack organization actions (e.g.,

Cs/W, % of CsW and Air Cs/W).

The study carried out with players of English Premier League (EPL) reported that central defender's offensive contribution had evolved by providing additional pass options when the teams was in ball possession (Bush et al., 2015). However, our findings showed that there were no-significant differences between domestic and foreign players in the passing related actions; as it was mentioned above, the most defenders from CSL did not take part in the build-up of their team attacks, being focused just on defensive actions. As far as the most of defenders in the CSL are domestic players, their attacking capacities and technical-tactical skills in general are not as good as of players from main European Leagues (e.g., EPL, la Liga, etc.), this fact can explain why Chinese players preferred to accomplish firstly their defensive duties instead of participating in attacking process during match play. Another explanation may be related to the differences in playing styles of Asian and European teams (Vamplew, 2017).

Findings of the current study regarding the midfielders are similar to the previous results observed in the games of the La Liga (Liu, Gomez, et al., 2016). Liu and colleagues (2016) verified that both wide and central midfielders from strong teams made more passes and had a higher participation in attacking and defensive actions, with the exception of crossing; they also received more yellow cards than players from weak teams. These findings demonstrate that wide midfielders from weak team employed more strategies of passing the ball from wide position into the opponent's area (cross) (Liu, Gomez, et al., 2016). Meanwhile, central midfielders from strong teams accomplished more passing and attacking actions (e.g., assist, etc.), but less

shots than players from weak teams. These results may indicate that the good central midfielder were more focused on organization of the offensive process, rather than on entering into the opponent's area (Gonçalves, Figueira, Maças, & Sampaio, 2014). The present study contradicts the results of the 2012-2013 season in the Spanish First Division Professional Football League (La Liga) (Liu, Gomez, et al., 2016). The foreign midfielders (central and wide midfielders) from CSL not only made more passes but also scored more goals than domestic midfielders. These results suggest that foreign midfielders from CSL demonstrated clearly better technical-tactical match performances than domestic players (Gai et al., 2018).

It is a common place to state that shooting quality is very important in soccer. Previous studies showed that success in soccer match depended more on the shots quality rather than on its quantity (Lago-Peñas et al., 2010; Liu et al., 2015a, 2015b; Yue, Broich, & Mester, 2014). Liu and colleagues (2016) Liu, Gomez, et al. (2016) reported that forwards from strong teams of Spanish First Division Professional Football League (La Liga) during season 2012–2013 performed better in the actions related to goal scoring (assists, shots on target) than weak teams. On the contrary, the study carried out with the games of CSL played in the 2014 season showed that the foreign forwards made more shots and shots on target than domestic forwards (Gai et al., 2018). Thus, the results of our study did not confirm the differences between domestic and foreign forwards in the actions related to goal scoring (goals, assists).

Another unexpected result reported in the literature is that the forwards from weak teams won more aerial duels and committed more fouls than forwards from strong teams (Liu, Gomez, et al., 2016). The findings of the current study contradicts these

results of season 2012-2013 of La Liga (Liu, Gomez, et al., 2016) the study demonstrated that foreign forwards performed better than domestic forwards in air challenges and also committed more fouls.

Our results allow us to conclude that, on the one hand, clubs of the CSL need to recruit the best foreign players of offensive outfield positions to cover some gaps in technical-tactical skills of domestic squads. On the other hand, the findings of longitudinal study of the CSL demonstrated that participation of foreign players in recent seasons contributed to the progress of domestic Chinese forwards, who obviously improved their performance in actions related to goals scoring in the 2016 season comparatively to the 2014 season. These data support the suggestion of Vamplew (2017) that each group of players assisted the other in the evolution of abilities over time (e.g. the evolution of domestic forwards' scoring abilities) and confirm the benefits of a foreign players' policy within the league.

The current study has provided the novel results regarding the match performance of domestic and foreign players across various positions. Firstly, the current results confirmed the significant differences on technical and tactical performances between foreign and domestic players. Concerning attacking positions (midfielder and forward) it was demonstrated that forward passes, number of shots and successful shots could differ foreign from domestic players (Gai et al., 2018). Secondly, this is the first study which has examined a wide range (49) of technical and tactical variables over a season and also provided some more specific information related to domestic and foreign forwards, such as: Ps to the RA and Ps to the R. The results of our study indicate that foreign forwards prefer to play more on the right side than left

side of the pitch, which can be explained by the fact that most foreign forwards used predominantly their right foot to play rather than with the left foot. Another explanation can be the imbalance of the players' recruitment to the CSL. For example, in the 2014 season a total of 191 domestic forwards and 396 foreign forwards were recruited to the CSL. These data clearly demonstrated that the better quality foreign forwards are often sought after by CSL clubs, due to a reliance on these players to enhance team success over a full season (Gai et al., 2018).

Some limitations of this study should be noted and considered in the further research. First of all, the physical and positional performance variables need to be included into analysis along with the technical and tactical performance variables, since the physical, positional and technical-tactical performance are related during a match play. The situational factors (match location, match outcome and both teams quality) should also be taken into account in the next stage of the research, because these situational factors can influence the individual match performances regardless of player nationality. In addition, it would be interesting to verify how the performance of foreign and domestic players is related to the end-of-season team ranking or team success during a complete season (Abbott, Brownlee, Harper, Naughton, & Clifford, 2018; Yang, Leicht, Lago, & Gómez, 2018).

6.5 Conclusion

The results of this study revealed the significant differences in technical-tactical performance between domestic (Chinese) and foreign (non-Chinese) players of the CSL, when the data have been analyzed according to playing positions. These distinctions may help coaching staff to make more appropriate decisions on team

composition. Additionally, more specific and match-related tactical skills need to be included in the training process, focusing on the key areas of attack and/ or defense, the ability to build up attack on the right and left side during match play, the combination of play and set pieces, etc. Finally the post-match assessment of individual performance (e.g. technical, tactical, and physical) can be more objective if it considers the team styles of play, because in the recruitment process the priority should be given to the foreign players who fit best to the playing style of team.

Tesis Doctoral

D. Yang Gai

CHAPTER 7
Conclusions, Limitations and
Future Directions

Chapter 7 Conclusions, Limitations and Future Directions

The main objective of this PhD thesis is to examine match performance profiles of soccer teams and players based on match-related statistic integrating with influencing factors in the Chinese Football Super League (CSL). In order to accomplish this, the first Chapter is general introduction of main findings related physical, technical and tactical aspects, the following Chapters are from two to six, which were carried out to analyse match performance of team and player. The final Chapter is main conclusions of the main findings of all the studies which were carried out are presented, their limitations indicated, and suggestions made for further research.

7.1 Main Conclusions and outcomes of the PhD Thesis

(i) (Chapter 2) was to identify the key physical and technical performance variables that best differentiated teams according to team quality (quartile ranked groups: 1st to 4th, 5th to 8th, 9th to 12th, and 13th to 16th). The study indicated that all variables were similar between groups except for the percentage of possession, OPP, Final 1/3 entries, Penalty Area Entries, 50-50 challenges, and fouls committed ($p < 0.05$ and small effect size values). In particular, high-ranked teams demonstrated physical (greater total sprint distance, less total distance covered without possession) and technical (greater match time of possession, Final 1/3 entries and 50–50 challenges) performance variables compared to lower-ranked teams. Additionally, these performance variables highlighted key qualities for coaches to develop for match and season success at the elite level.

(ii) (Chapter 3) was to describe and measure different playing style that teams adopt

during a match play in the CSL. The current study has identified five factors from the exploratory factor analysis: Factor 1 (“possession” style of play), Factor 2 (set pieces attack); Factor 3 (counterattacking play) and Factor 4 and 5 (transitional play). And results suggested that the teams Guangzhou Evergrande and Guangzhou RF are more focus on Factor 1; the team Henan Jianye is centred on Factor 2; the team Beijing Guoan is centred on both Factor 1 and Factor 3; the team Hebei China Fortune is focused on Factor 4; the team Shanghai Shenhua is focused on Factor 5, and the team Yanbian perform high in both Factors (4 and 5).

(iii) (Chapter 4) was to examine the performance characteristic of Chinese (domestic) and non-Chinese (foreign) players according to playing positions in the CSL. Results of current study showed that we found the significant differences in physical and technical performances between Chinese (domestic) and non-Chinese (foreign). Noteworthy, foreign players performed more passes, shots, and aerial and ground challenges when compared with domestic players. While fewer physical performance differences were observed between groups, foreign wide defender and wide midfielder covered greater distances than their counterparts, and domestic forward covered greater distances than their foreign counterparts. Subsequently, categorization (e.g. good or bad) of domestic and foreign players were based upon match performances in terms of key variables that discriminated each playing position. This analytical model was significant for each playing position; the best foreign players exhibited greater values for most variables per playing position (e.g. CD, WD, CM, WM and F) compared to the worst foreign and best/worst domestic players. Lastly, the best domestic players were better than the worst foreign players for total distance (CD, WD, WM and F), high-intensity (WM), number of high-intensity actions (WM),

sprint (WM), number of sprint (WM), sprint of total distance (WM), number of passes (CM and WM), number of forward passes (CM), number of ground challenges (CD), number of shots and shot success (F).

(iv) (Chapter 5) confirmed the differences in match performance profiles of starter and substitute players across different playing positions. To the best of our knowledge this is the first study to evaluate the match performance of three groups of players - starters, substitutes and whole-match players, as well as to perform intra comparison of the players, while starters or substitutes, in the Asian league (CSL). Regarding a technical performance, this study demonstrated substitutes make more number of actions than starters, but the efficacy of their actions is lower. Concerning a physical activity, substitutes performed greater work-rate than starters. The current finding shows that substitutes influence more players' physical performances than technical performances during a match play in the CSL. Our findings demonstrated that from physical perspective substitutions seem to be effective, but its influence on the technical performance and match outcome still need to be established.

(v) (Chapter 6) was to examine the performance characteristics between players' nationalities (domestic and foreign) based upon playing positions (defender, midfielder and forward) in the CSL. Results of current study confirmed the significant differences in match performances profiles between domestic and foreign players. Worthwhile, for defenders, foreign players made more than domestic players in defending related actions, such as challenges won (CsW) and % of challenges won (% of CsW). For midfielders, foreign players made more than domestic players in passing and organizing related actions such as attacking challenges (ACs), attacking

challenges success (ACsS), dribbles (Ds) and dribbles success (DsS), but made less in defending related actions such as defensive challenges (DCs). For forwards, foreign players made more than domestic players in passing and organizing related actions such as crosses (Cs), ACs, ACsS, and Ds.

7.2 Limitations and Future Directions

There are some limitations to this thesis, which provide important pointers for future research.

(i) (Chapter 2) the use of classifications in this study (quartiles) may have lacked the necessary sensitivity to differentiate physical and technical performances as a function of team quality (Mao et al., 2016). Future studies are encouraged to examine alternative classification approaches such as the use of league ladder positions or smaller groupings.

(ii) (Chapter 3) the importance of these variables is reflected in potential changes in the teams' and players' activities as a response to match situations. More matches, variables and different competitions should be considered to provide conclusive descriptions and measures for playing styles and generalisability of the data. Therefore, the combined effects of offensive and defensive tactics and opponent interactions should be included in the future.

(iii) (Chapter 4) some physical and technical variables examined may be influenced by tactical or playing styles (e.g. playing formation) (Bradley et al., 2011; Folgado et

al., 2018) which were not accounted for in the current analysis. Discrimination between the non-Chinese players who had played in the CSL for consecutive seasons and those in their first season (e.g. repeated measures design) may clarify the influence of playing styles. For example, non-Chinese players may perform at a greater level in their first year within the CSL compared to after playing a number of seasons in the CSL. Future studies may clarify the impact of playing style on match performances by foreign and/or domestic players. Additionally, whether the differences between domestic and foreign players based upon technical and physical will directly influence the team ranking (end-of-season) or team success during a complete season (Abbott et al., 2018; Yang et al., 2018) remains to be determined.

(iv) (Chapter 5) the intra comparison (starters vs. substitutes) needs to provide larger sample size and enable to investigate the impact of substitutes according to specific positions. In addition, further research should explore whether the situational factors (match location, match status and teams quality) influence the individual match performance of three groups of players – starters, substitutes and whole-game players.

(v) (Chapter 6) did not consider the physical variables, which need to be included into analysis along with the technical and tactical performance variables, since the physical, positional and technical-tactical performance are related during a match play. Therefore, the further research would be interesting verify how the performance of foreign and domestic players is related to the end-of-season team ranking or team success during a complete season (Abbott, Brownlee, Harper, Naughton, & Clifford, 2018; Yang, Leicht, Lago, & Gómez, 2018).

(vi) The studies (Chapter 2-6) is only examined over a season/or competitions. A large sample (multiple seasons and/or competitions) is required for the future studies in order to provide meaningful results and more convincing predictive models (Sarmiento et al., 2018), with a longitudinal study may demonstrate greater applicability of the current results within elite soccer (Lundberg & Weckstrom, 2017)

(vii)The studies (Chapter 3 to 6) did not consider the situational variables (e.g. match location, quality of opponent, match status and match half) which may affect the interactional context. In addition, previous studies have emphasized the importance of accounting for situational variables during the assessment of sport performance (Lago-Peñas, 2012). In addition, the further research should be considered for multifactorial examination of a team's and player's performance in the CSL (e.g. relationships among physical, technical and tactical variables).

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D. Yang Gai

CHAPTER 8
Practical Applications

Chapter 8 Practical Applications

The current PhD thesis provides a novel and unique match performance profiles of team and player during a completions soccer season in the CSL. Therefore, the results from the current PhD thesis could be provided important information to coaching staff related to training session, team management and structure, players' performance assessment, recruitment process.

(i) (Chapter 2) the key variables of technical and physical were identified in the current study, which has provided groundwork evidence and clearer indications of the evolution of team success. In addition, the main purpose for coaching staff to assist in the training of athletes and development of tactical strategies for success during elite competition over a full season.

(ii) (Chapter 3) the different playing styles (Possession, Set Piece, Counterattack and Transitional Play) and correlated performance indicators were identified in the current study. The current findings suggested that: i) the results may allow coaches and analysts to classify the teams' styles so that playing styles profiles could be created for each teams. Positive or negative scores for the 5 factors would determine how much a team relies on one specific style or combination of these styles; 2) by establishing the impact of particular styles of play on performance, teams and players can be observed, when possible, with appropriate adjustments being made to analyses based on knowledge of such effects. Similarly, post-match assessment of the technical, tactical and physical aspects of performance can be more objective by factoring in the effects of styles of play; 3) if a performance analyst or a coach has identified that the

technical, physical or tactical aspects of performance are adversely influenced by specific playing styles, the plausible causes can be examined and then the match preparation can be focused on reducing such effects.

(iii) (Chapter 4) the study of these dissimilarities (differences between domestic and foreign players) will help coaching staff to account for diverse playing styles based upon country of origin and develop training to enhance individual technical and physical skills of players for team success over a season. Further, categorization (e.g. good or bad) of foreign and domestic players was possible based upon match performances and could be used to substantiate player worth. The current study provided match performance profiles for coaches, performance analysts and managers to improve the recruitment process and team's composition of domestic and foreign players.

(iv) The results from current study (Chapter 5) provide coaches with new information regarding substitutes' performance profiles per position, which can be integrated into overall coaching strategy helping to optimize coaches' decisions and improve team performance in the match play.

(v) The results from current study (Chapter 6) will help coaches to lay out team's strategies based on different playing styles according to the players' nationality to succeed over a season. Additionally, the current study provided match performance profiles for coaches to improve the recruitment and logical composition of Chinese and non-Chinese players.

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