

Analysis of Goal Characteristics in the Men's Football Tournament of the 2023 Hangzhou Asian Games

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Abstract: Research Objectives: This study examines the goalscoring characteristics of the men's football tournament at the 2023 Asian Games in Hangzhou. It aims to investigate the correlations between the basic information of participating teams, their goalscoring features, and the total number of goals scored; to explore both the individual and shared characteristics of teams across various goalrelated indicators; and, based on an analysis of the underlying causes of these features, to offer pertinent recommendations that can serve as a theoretical reference for the formulation of technical and tactical strategies in Chinese football. Through a systematic analysis of the goalscoring patterns in this edition of the Asian Games, this research also seeks to provide coaching staff at all levels of professional clubs in China with practical references for football tactical training and inmatch application, thereby contributing to the refinement of domestic training philosophies and their practical implementation; **Research Methods:** The study analysed 121 goals scored in the men's football competition of the 19th Asian Games Hangzhou 2023, examining variables such as goal time, goalscorer's position, shooting body part, number of attacking players involved, goalscoring zone, assist zone, and shooting mode. the primary methods employed included video replay observation, mathematical statistics, literature review, and logical analysis; **Research Results:** (1) A total of 121 goals were scored in the tournament. the number of goals in the second half exceeded that in the first half, with the highest frequency occurring during the 6175 min period. (2) Forwards recorded the highest number of goals, followed by midfielders and then defenders. (3) the most effective shooting method was shooting after receiving and adjusting the ball, and the most frequently used and successful shooting body part was the inside of the foot. (4) Goals were most often

scored when 34 players participated in the attacking move, followed by 12 players. (5) the zone with the highest goal count was Zone 3, which was also the zone with the most assists; **Research Conclusions:** (1) Based on match time and players' physical condition, substitutions should be fully utilised, particularly during the peak goalscoring period (6175 min). In addition, training programmes should emphasise both aerobic endurance and anaerobic explosive power to enhance players' overall fitness. (2) the specific responsibilities of players in each position should be clearly defined, while their offensive and defensive capabilities should be systematically improved. (3) Shooting after receiving and adjusting the ball proved to be the most successful method, and using the inside of the foot yielded the highest conversion rate in this tournament. Therefore, coaches at all levels should prioritise training drills for receivingadjustingshooting and insidefoot shooting, while also developing players' ability to shoot with various parts of both feet. (4) Zone 3 was identified as the most prolific for both goals and assists. In this zone, attacking players often have a highprobability scoring opportunity after a simple adjustment, yet the defence is also tightly organised. Tactical combinations involving 34 players can effectively stretch the defence, thereby creating shooting chances for the final striker.

Keywords: Men's Football Matches; Asian Games; Goal Characteristics

1. Introduction

The Asian Games (officially abbreviated as the Asiad) is the largest comprehensive multi-sport event in Asia, hosted in rotation by member countries of the Olympic Council of Asia and held every four years. the football tournament of the Asian Games features national teams from across the continent and enjoys significant influence and recognition in Asia. Bringing

together the finest national football sides from each Asian country, the Asian Games football competition showcases the advanced tactical concepts and outstanding individual skills of the participating teams. Therefore, by studying and analysing the goal-scoring characteristics of the teams in the men's football tournament at the 2023 Hangzhou Asian Games, and by exploring the tactical and technical patterns of this edition, we can promote the healthy development of professional football in China, guide and improve the technical and tactical training of Chinese competitive football, gain insight into and learn from the advanced trends in Asian football tactics, and provide valuable guidance for the tactical application and daily training of the Chinese men's national football team.

In most scholarly studies on goal-scoring characteristics in football matches, considerable attention has been devoted specifically to the temporal distribution of goals. Researchers typically divide regulation match time into 15-minute intervals, yielding six periods, and count the number of goals in each period; the number of shots or goals per period is then used to measure scoring efficiency and other related factors. Armatas [1] (2007) et al., in their paper Relationship between time and goal scoring in soccer games: Analysis of three World Cups, observed that in the 1998, 2002 and 2006 World Cups, analysis of the first and second halves showed that more goals were scored in the second half. From a sports physiology perspective, as match time progresses, players naturally experience fatigue and a decline in physical condition, which tends to cause defensive errors, thereby forming a distinctive temporal pattern in goal scoring. Yu Qifei [2] (2016) and others, in their study on goals scored in the final phase of the 19th FIFA World Cup, concluded that when reviewing match footage, they divided the footage into 15-minute segments and tallied the goals in each segment. the results showed that the 0–15 min period had the fewest goals, representing a tentative phase for both teams; in the 16–30 min period, the number of goals increased as both teams gradually adapted to the match environment and sought to seize the initiative through scoring; in the 31–45 min period, both sides strengthened their defence, hoping to enter the second half with a favourable result. Mao Jiansheng [3] (2019) and others took the 169 goals scored in the 64 matches of the 2018 FIFA World Cup final tournament as their

research subject. Following FIFA's conventional statistical method, they divided regulation time into six 15-minute periods, with stoppage time counted separately and extra time excluded. the goal data showed that the top three periods, in descending order, were 46–60 min, 61–75 min, and 31–45 min. In summary, most scholars studying goal-scoring characteristics in football matches agree that during the first half, players on both sides adopt conservative tactics, resulting in fewer goals; as the match progresses into the second half, the decline in physical fitness often leads to defensive errors and thus more goals, with the second half producing higher goal totals and reaching a peak scoring period; In the analysis of goal-scoring characteristics in football matches, different scholars have adopted different divisions of the areas where shots and goals occur. However, most scholars focus their research on the area within 30 meters forward from the goal line, dividing this space into various shooting and goal-scoring zones. Zhou Zhangbin (2003) proposed that, based on statistical results from the 13th, 14th, and 15th World Cups regarding shooting and goal-scoring areas, the penalty area had the highest number of goals, followed by the 25–30m zone, with the goal area ranking third and the small-angle zones on both sides having the fewest. He also noted a trend where the goal rate inside the penalty area and goal area decreased from tournament to tournament, while the goal rate in the 25–30m zone increased. This is because that zone features multiple defensive layers and dense personnel, which greatly restricts attacking tactics such as dribbling breakthroughs and penetrating passing combinations. In order to break through dense defenses, the gradual expansion of shooting areas inevitably increases the probability of scoring from the 25-30m zone [4]. Liang Shuangquan [5] (2019), in his analysis of goal-scoring characteristics in the quarterfinal stage of the 2018 Men's World Cup, concluded that different shooting zones have a significant impact on the number of goals. Shots taken in Zones 2 and 3, which are closer to the penalty area, create great difficulty for goalkeepers in making saves, accounting for 30.43% of total goals. Other zones are farther from the goal and more angled, requiring players to have excellent individual technique and physical fitness; shooting from these areas is more difficult, making them more suitable for passing and assisting to create goal-scoring opportunities. Zhang Shuai (2019), in his

analysis of shooting and goals in the knockout stage (round of 16) of the 2018 FIFA World Cup in Russia, showed that goal-scoring areas were mainly concentrated in Zones 1 and 2, which also provided the most goal-scoring opportunities. Zone 1 accounted for 23 goals, representing 50% of total goals. the front left side of the attacking half near the penalty area was the shooters' preferred zone, as right-footed players could shoot comfortably with their dominant foot in this area. Zone 2, located on the front right side of the attacking penalty area, accounted for 13 goals, or 28.3% of total goals. In this zone, players mainly scored by receiving passes from teammates and taking first-time shots. Zones 4 and 5 each had only 1 goal, as attacking players were restricted by shooting angles and well-positioned defenders, leaving them without good angles to finish. Zones 6 and 7 together produced 8 goals, accounting for 4.3% and 13.0% of total goals respectively; most goals in these two zones came from free kicks and long-range shots. Zones 3 and 8 had zero goals because there were no optimal shooting angles or opportunities; in these areas, most players chose to pass to teammates who were closer to the goal or in better shooting positions [6]. In summary, within the area extending 30 meters forward from the goal line, the zone from the goal area to the penalty area near the penalty spot, where shooting distances are shorter, yields the highest number of goals. In this region, players can shoot with greater speed and wider angles, making it more difficult for defenders to block and reducing the goalkeeper's chance of making a save. Therefore, the area within 30 meters forward from the goal line constitutes the primary focus of goal-area research; Zhang Qi and Zhang Zhigang (2020), in their study on the goal-scoring characteristics of the top four teams in the 21st FIFA World Cup, divided shooting methods into nine categories: direct foot shot, shot after receiving and adjusting, individual breakthrough, header, direct free kick, penalty kick, own goal, rebound follow-up shot, and VAR penalty kick. the results showed that the most prolific shooting methods were "direct foot shot" and "header". Among the top four teams, players more often shot directly after receiving the ball during matches, which increased shooting speed, reduced shooting time, and decreased the probability of being blocked or disrupted by defenders [7]. He Wei et al. (2015), in their research on shooting and goal-scoring characteristics in the 2013 Chinese Super League, classified shooting methods into direct free kick,

indirect free kick, penalty kick, cooperative play shot, dribbling breakthrough shot, shot after stopping and controlling the ball, and direct shot [8]. the study found that the top four shooting methods in the 2013 CSL were direct shot, dribbling breakthrough shot, shot after stopping and controlling the ball, and direct free kick, accounting for nearly 98% of all shooting methods; penalty kicks, indirect free kicks, and cooperative play shots accounted for less than 3%. Yao Dunsheng et al. (2020), in their analysis of goal-scoring characteristics in the 21st FIFA World Cup, divided shooting methods into eight types: first-time shot (direct volley), header, stopped-and-adjusted shot, dribbling breakthrough shot, free-kick shot, long-range shot, penalty kick, and own goal. the study concluded that the dribbling breakthrough shot was the least effective scoring method. Due to the high physical intensity of modern football, the body contact during tackles is extremely fierce, and the more passes attempted, the higher the error rate; this requires players to complete their shots as quickly as possible [9].

2. Research Subjects and Methods

2.1 Research Subjects

This study takes the 121 goals scored in a total of 45 matches involving 21 participating teams (Syria and Afghanistan withdrew) in the men's football tournament of the 2023 Hangzhou Asian Games as its research subject. Shown in table 1.

2.2 Research Methods

2.2.1 Literature Review

Relevant literature on football goal-scoring characteristics was consulted through the China National Knowledge Infrastructure (CNKI). Statistical data on the men's football tournament of the 19th Asian Games Hangzhou 2023 were collected and compiled through searches on the official Asian Games website, the official FIFA website, and other sources.

2.2.2 Video Observation Method

This study conducted repeated and multi-angle observations and analyses of the video replays from all 45 matches involving the 21 participating teams in the men's football tournament of the 19th Asian Games Hangzhou 2023. the following variables were recorded and summarised for the 121 goals scored in the tournament: temporal characteristics of goals, number of goals scored by players in different positions, body parts used

for scoring, number of attacking players involved in each goal, goal location, assist location, and shooting method.

2.2.3 Mathematical Statistics Method

Statistical analyses of the collected and summarised data were performed using data analysis software such as Microsoft Word and SPSS.

(1) Descriptive statistical analysis. Descriptive

Table 1. Grouping of Teams in the Asian Games Football Tournament

Group	Teams			
A	China	Bangladesh	Myanmar	India
B	Vietnam	Saudi Arabia	Iran	Mongolia
C	Uzbekistan	Hong Kong (China)	Syria (withdrew)	Afghanistan (withdrew)
D	Japan	Palestine	Qatar	
E	South Korea	Bahrain	Thailand	Kuwait
F	North Korea	Indonesia	Kyrgyzstan	Chinese Taipei

3. Results and Analysis

3.1 Analysis of Goal Time Characteristics

In this study, the match time of the men's football tournament at the 19th Asian Games Hangzhou

Table 2. Descriptive Statistics of Goals Scored in Different Match Time Periods

Time Period(min)	0-15	16-30	31-45	45+	46-60	61-75	76-90	90+	91-120
Number of Goals	17	18	18	5	18	21	15	7	2
Percentage(%)	14.06	14.87	14.87	4.13	14.87	17.36	12.40	5.79	1.65

As shown in Table 2, in the men's football tournament of the 19th Asian Games Hangzhou 2023, 17 goals were scored in the 0–15 min period, accounting for 14.06% of the total; 18 goals in the 16–30 min period, accounting for 14.87%; 18 goals in the 31–45 min period, accounting for 14.87%; 5 goals in the 45+ min period, accounting for 4.13%; 18 goals in the 46–60 min period, accounting for 14.87%; 21 goals in the 61–75 min period, accounting for 17.36%; 15 goals in the 76–90 min period, accounting for 12.40%; 7 goals in the 90+ min period, accounting for 5.79%; and 2 goals in the 91–120 min period, accounting for 1.65%. the chi-square test analysis of goals across the different match time periods is shown in Table 3.

Table 3. Chisquare Test Analysis of Goals Scored in Different Match Time Periods

Total Goals	Expected Value	χ^2 Value	Degrees of Freedom (df)	P Value
121	13.4	28.132	8	0.00

As shown in Table 3, the chi-square test results for goals scored in different match time periods indicate that the χ^2 value for the nine periods is 28.132, with an expected value of 13.4, 8 degrees of freedom, and a p-value of 0.00 ($p < 0.001$). This demonstrates that the distribution of goals

statistics (frequencies and percentages) were computed for the 121 goals with respect to temporal characteristics, goals by position, body parts used, number of attacking participants, goal location, assist location, and shooting method.

(2) Chi-square test. After compiling the statistical data for the above variables, chi-square tests were conducted to examine the distributions and differences among the categories.

2023 was divided into 15-minute intervals, yielding nine periods: 0–15 min, 16–30 min, 31–45 min, 45+ min, 46–60 min, 61–75 min, 76–90 min, 90+ min, and 91–120 min. the descriptive statistics for the different match time periods are shown in Table 2.

across the different match time periods is highly statistically significant.

3.2 Analysis of Goal Characteristics by Player Position

The analysis of goal characteristics by player position is shown in Table 4.

Table 4. Descriptive Statistics of Goals Scored by Player Position

Player Position	Forwards	Midfielders	Defenders
Number of Goals	72	41	8
Percentage(%)	59.50	33.88	6.62

As shown in Table 4, in the men's football tournament of the 19th Asian Games Hangzhou 2023, forwards scored a total of 72 goals, accounting for 59.50% of the total; midfielders scored 41 goals, accounting for 33.88%; and defenders scored 8 goals, accounting for 6.62%. the chi-square test analysis of goals by player position is shown in Table 5.

Table 5. Chisquare Test Analysis of goals Scored by Player Position

Total Goals	Expected Value	χ^2 Value	Degrees of Freedom (df)	P Value
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121	40.3	50.793	2	0.00
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As shown in Table 5, for the men's football tournament of the 19th Asian Games Hangzhou 2023, the total number of goals was 121. the chi-square test results for goals scored by different player positions show an expected value of 40.3, a χ^2 value of 50.793, 2 degrees of freedom, and a p-value of 0.00 ($p < 0.001$). This indicates

that the distribution of goals among different player positions is highly statistically significant.

3.3 Analysis of Goals Scored Using Different Body Parts

The descriptive statistics for goals scored using different body parts are presented in Table 6.

Table 6. Descriptive Statistics of Goals Scored by Body Part

Body Part Used	Header	Medial Instep	Instep	Outside of Foot	Inside of Foot	Other
Number of Goals	16	28	15	1	56	5
Percentage(%)	13.22	23.14	12.40	0.83	46.28	4.13

As shown in Table 6, in the men's football tournament of the 19th Asian Games Hangzhou 2023, headers accounted for 16 goals (13.22% of the total); medial instep shots accounted for 28 goals (23.14%); instep (laces) shots accounted for 15 goals (12.40%); outside-of-foot shots accounted for 1 goal (0.83%); inside-of-foot shots accounted for 56 goals (46.28%); and goals scored using other body parts accounted for 5 goals (4.13%). the chi-square test analysis of goals scored using different body parts is shown in Table 7.

Table 7. Chisquare Test Analysis of Goals Scored by Body Part

Total Goals	Expected Value	χ^2 Value	Degrees of Freedom (df)	P Value
121	20.2	98.521	5	0.00

As shown in Table 7, for the men's football tournament of the 19th Asian Games Hangzhou 2023, the total number of goals was 121. the chi-square test results for goals scored using different body parts show an expected value of 20.2, a χ^2 value of 98.521, 5 degrees of freedom, and a p-value of 0.00 ($p < 0.001$). This indicates that the distribution of goals by body part is highly statistically significant.

3.4 Analysis of the Number of Attacking Players Involved in Goals

The descriptive statistics for goals scored with different numbers of attacking players involved are presented in Table 8.

Table 8. Descriptive Statistics of Goals by Number of Attacking Players Involved

Number of Attacking Players Involved	1-2	3-4	5-6	7-8	9-11
Number of Goals	30	78	12	1	0
Percentage(%)	24.79	64.46	9.92	0.83	0

As shown in Table 8, a total of 30 goals (24.79%) were scored with 1–2 players involved in the attack; 78 goals (64.46%) were scored with 3–4 players involved; 12 goals (9.92%) with 5–6

players involved; 1 goal (0.83%) with 7–8 players involved; and 0 goals with 9–11 players involved. the descriptive results indicate that in this Asian Games men's football tournament, the highest number of goals (78) were scored with 3–4 players participating in the attack, while the lowest (0) occurred with 9–11 players. This suggests that local attacking combinations involving 3–4 players are more likely to produce goals, and that the number of goals generally tends to decrease as the number of attacking participants increases. the chi-square test analysis of goals by number of attacking players involved is shown in Table 9.

Table 9. Chisquare Test Analysis of Goals by Number of Attacking Players Involved

Total Goals	Expected Value	χ^2 Value	Degrees of Freedom (df)	P Value
121	30.3	114.669	3	0.00

As shown in Table 9, for the men's football tournament of the 19th Asian Games Hangzhou 2023, the total number of goals was 121. the chi-square test results for the number of attacking players involved show an expected value of 30.3, a χ^2 value of 114.669, 3 degrees of freedom, and a p-value of 0.00 ($p < 0.001$). This indicates that the distribution of goals across different numbers of attacking participants is highly statistically significant.

3.5 Analysis of Goal Shooting Methods

The descriptive statistics for goal shooting methods are presented in Table 10.

As shown in Table 10, in the men's football tournament of the 19th Asian Games Hangzhou 2023, 32 goals (26.45%) were scored via first-time shots; 45 goals (37.19%) via shots after receiving and controlling the ball; 7 goals (5.79%) via shots after dribbling past opponents; 9 goals (7.44%) via penalty kicks; 6 goals (4.96%) via direct free kicks; 19 goals (15.70%) via headers; and 3 goals (2.47%) were own goals. the

chi-square test analysis of goal shooting methods is shown in Table 11.

Table 10. Descriptive Statistics of Goal Shooting Methods

Shooting Methods	First-time shot	Shot after receiving and controlling	Shot after dribbling	Penalty kick	Header	Own goal
Number of Goals	32	45	9	6	19	3
Percentage(%)	26.45	37.19	5.79	4.96	15.70	2.47

Table 11. Chisquare Test Analysis of Goal Shooting Methods

Total Goals	Expected Value	χ^2 Value	Degrees of Freedom (df)	P Value
121	17.3	86.397	6	0.00

As shown in Table 11, for the men's football tournament of the 19th Asian Games Hangzhou 2023, the total number of goals was 121. the chi-square test results for goal shooting methods show an expected value of 17.3, a χ^2 value of 86.397, 6 degrees of freedom, and a p-value of 0.00 ($p < 0.001$). This indicates that the distribution of goals across different shooting methods is highly statistically significant.

Table 12. Descriptive Statistics of Goal Areas

Goal Area	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Penalty Spot
Number of Goals	15	1	76	19	1	9
Percentage(%)	12.40	0.83	62.81	15.70	0.83	7.43

As shown in Table 12, in the men's football tournament of the 19th Asian Games Hangzhou 2023, 15 goals (12.40%) were scored from Zone 1; 1 goal (0.83%) from Zone 2; 76 goals (62.81%) from Zone 3; 19 goals (15.70%) from Zone 4; 1 goal (0.83%) from Zone 5; and 9 goals (7.43%) from the penalty spot. the chi-square test analysis of goal areas is shown in Table 13.

Table 13. Chisquare Test Analysis of Goal Shooting Methods

Total Goals	Expected Value	χ^2 Value	Degrees of Freedom (df)	P Value
121	20.2	198.587	5	0.00

As shown in Table 13, for the men's football tournament of the 19th Asian Games Hangzhou 2023, the total number of goals was 121. the chi-square test results for goal areas show an expected value of 20.2, a χ^2 value of 198.587, 5 degrees of freedom, and a p-value of 0.00 ($p < 0.001$). This indicates that the distribution of

Table 14. Descriptive Statistics of Assist Areas

Assist Area	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Own Half
Number of Goals	1	17	40	20	7	5
Percentage(%)	1.11	18.89	44.44	22.22	7.78	5.56

Note: A total of 121 goals were scored in the men's football tournament of this Asian Games. Among them, 12 goals resulted from interceptions and tap-in rebounds; 1 goal from a corner-kick header; 9 goals from penalty kicks; 3 goals from own goals; and 6 goals from direct free kicks. These 31 goals were scored without an

3.6 Analysis of Goal Areas

The goal area division is shown in Figure 1.



Figure 1. Schematic Diagram of Goal Area Division

The descriptive statistics for goal areas are presented in Table 12.

goals across different goal areas is highly statistically significant.

3.7 Analysis of Assist Areas

The division of assist positions is shown in Figure 1.

The descriptive statistics for player assist areas are presented in Table 14.

As shown in Table 14, in this Asian Games men's football tournament, the total number of assisted goals was 90. the descriptive statistics show that 1 assisted goal (1.11%) came from an assist made in Zone 1; 17 assisted goals (18.89%) from Zone 2; 40 assisted goals (44.44%) from Zone 3; 20 assisted goals (22.22%) from Zone 4; 7 assisted goals (7.78%) from Zone 5; and 5 assisted goals (5.56%) from the assisting player's own half. the chi-square test analysis of assist areas is shown in Table 15.

Table 15. Chisquare Test Analysis of Assist Areas

Total Goals	Expected Value	χ^2 Value	Degrees of Freedom (df)	P Value
90	15	67.600	5	0.00

As shown in Table 15, the chi-square test results for player assist areas show an expected value of 15, a χ^2 value of 67.600, 5 degrees of freedom, and a p-value of 0.00 ($p < 0.001$). This indicates that the distribution of goals across different assist areas is highly statistically significant.

4. Discussion

Research findings indicate that the goal rate in the first half is lower than that in the second half, with first-half goals accounting for approximately 43.8% of total match goals. During the 0–15 min period of the first half, both teams start to probe each other and are in good physical condition, but defensive errors are not uncommon; goals in this period account for about one-third of first-half goals. The goal rate in the second half accounts for about 44.6% of total match goals. The goal rate during the 46–60 min period of the second half is comparable to that of each period in the first half, possibly because after the halftime break, players' physical functions have not yet reached their optimal state at the start of the second half. During the 61–75 min period, since both sides have largely identified each other's offensive and defensive weaknesses and are still in good physical condition, both teams actively attack to seize the initiative. In the final 15 minutes before full time, which is the crucial moment for deciding the outcome, the intensity of both attack and defense is greater than in any other period; coupled with declining physical fitness and more conservative defending, the 76–90 min period has the lowest goal rate among all match periods. With the development and progress of football, players' techniques and tactics have continuously improved, and the overall timing of goals remains very stable, with goals occurring in all periods. Excellent physical fitness and skills can smooth out the peaks in goal scoring. The results also show that forwards score the most goals, accounting for 59.50% of total goals; to some extent, the performance of forwards determines the match outcome. Midfielders' goals account for more than half of forwards' goals, reflecting that midfielders are becoming increasingly important in matches, as they are involved in organizing attacks and timely defending. Defenders scored 8 goals, indicating a diversification of shooting positions among attacking players; players in all positions should not only perform their own roles well but also seize opportunities, adapt flexibly, and actively participate in both attack and defense to secure

victory. The results show that the foot is the primary body part for shooting, with foot shots accounting for about 82.6% of total goals; the high rate of foot shots is consistent with the basic characteristics of football. Among these, instep shots account for the highest proportion, while shots with the inside of the foot rank second, accounting for half of instep shots. Most football players are right-footed, and both instep and inside-foot shots involve a large swing of the kicking foot and a large contact area with the ball, which facilitates higher ball velocity and better directional control, in line with the general principles of sports biomechanics and human anatomy. The results indicate that the highest goal rate occurs when 3–4 players are involved in the attack, accounting for 64.46% of total goals; the attacking players are usually composed of 1 midfielder and 2–3 forwards, who achieve goals through coordinated tactical combinations between midfielders and forwards. Attacks involving 1–2 players rank second, accounting for 24.79% of total goals; the possible reasons include direct free-kick goals, steals leading to goals, penalties, corner kicks, own goals, etc. When more than 4 players are involved in the attack, the goal rate inversely decreases. The results show that Zone 3 has the highest number of goals, accounting for 62.81% of total goals, followed by Zone 4 and Zone 1. This indicates that the distance from the goal area is inversely related to the number of goals, because the area close to the goal is densely defended and the shooting angle is smaller. Zones 2 and 5 have fewer goals due to smaller shooting angles and longer distances, accounting for 0.83% of total goals. The results also show that Zone 3 players provide the most assists, accounting for 44.44% of total assists; in this zone, assisting players have the best shooting opportunities when in possession, but due to tight defending, they lose the shooting chance and thus cooperate with teammates to assist in scoring. Assists from Zones 2 and 4 follow, reflecting different football tactics such as crossing from the byline, straight passes with diagonal runs, diagonal passes with straight runs, etc. The results show that receiving and adjusting the ball before shooting is the most successful shooting method, accounting for 37.19% of total goals, indicating that this method is relatively stable and has a high conversion rate. First-time shots (volleys or one-touch shots) rank second, accounting for 26.45% of total goals, requiring strong spatial-temporal anticipation and

precise footwork. In modern football, defensive systems are increasingly sophisticated; defenders block passing lanes and closely mark receivers in advance, making it increasingly difficult to score with direct first-time shots. [10] Headed goals account for 15.7% of total goals, while dribbling breakthroughs followed by shots account for only 5.79%, indicating that the defense in this tournament was quite tough, and also reflecting that many teams lack technically proficient players like Neymar or Cristiano Ronaldo. In summary, goal timing, player position, shooting body part, number of attacking participants, goal zone, assist zone, and shooting method all have significant effects on the number of goals scored.

5. Conclusion and Recommendations

5.1 Conclusion

(1) In the 2023 Hangzhou Asian Games men's football tournament, a total of 45 matches were played, with 121 goals scored, averaging 2.69 goals per match. In terms of goal timing, the 61–75 min period was the peak scoring period. Video observation revealed that the main reason is that as the match progresses, defensive players' physical fitness declines, leading to errors.

(2) In the 2023 Hangzhou Asian Games men's football tournament, the number of goals scored by different positions ranked as follows: forwards > midfielders > defenders. Forwards remain the team's primary attacking force, while midfielders also performed well, participating in both attack and active defence. Defenders scoring goals was both unexpected and reasonable.

(3) the foot is the primary shooting body part, with inside-foot and instep shots being the most common. Inside-foot shots have a higher conversion rate. In this tournament, most players are right-footed, and using the inside of the foot for shooting is consistent with the general principles of sports biomechanics and sports anatomy.

(4) In the 2023 Hangzhou Asian Games men's football tournament, most goals were scored through cooperative attacks involving 3–4 players, accounting for 64.46% of total goals. This type of cooperation mostly employs basic football tactics. the next most common was 1-2 player combinations, which mainly involve corner kicks or steal-and-shoot situations. When more than 4 players participated in the attack, the number of goals decreased instead. This indicates that football cooperation should be precise rather

than overly numerous.

(5) Zone 3 offers a larger shooting angle, is closer to the goal, and has fewer defenders, making it the primary goal-scoring zone, accounting for 62.81% of total goals. Zone 4 and Zone 1 follow; the former is farther from the goal, while the latter has more defenders. Zones 2 and 5 also produced a small number of goals.

(6) In this tournament, Zone 3 was the main assist zone. In this area, after receiving the ball, the shooter only needs to adjust and shoot with the foot to have a high probability of scoring. Zones 4 and 2 follow; the former requires the shooter to break through before shooting, while the latter requires forwards to take a first-time shot, resulting in lower conversion rates. Zones 5, the own half, and Zone 1 had the lowest assist rates, mainly because players, after receiving the ball, face small shooting angles, many defenders, and long distances, thus missing scoring opportunities.

(7) Among the different shooting methods that led to goals, the order was: receive-adjust-shoot > first-time shot > header > penalty > dribble-breakthrough-shoot > direct free kick > own goal. Receive-adjust-shoot, first-time shots, and headers are the most effective and highest-conversion shooting methods. Other shooting methods account for a smaller proportion of goals, but the choice of shooting method remains important.

5.2 Recommendations

(1) In the temporal division of goal scoring, it is found that as time progresses and physical fitness declines, a peak in goals will emerge. Based on the pattern of this peak, scientific and reasonable substitution plans should be formulated according to the players' physical condition. In daily training, more emphasis should be placed on aerobic endurance and anaerobic explosive power training to improve players' physical capacity.

(2) In routine training, appropriate shooting drills should be arranged for forwards, midfielders, and defenders, so that they can seize shooting opportunities in matches and produce unexpected effects.

(3) During the training process, specific situations should be designed to practise shooting with different body parts. Shots with the laces (instep) are faster, shots with the outside of the foot have greater swerve, and shots with other parts can be surprising. Opportunities on the pitch are fleeting; adequate shooting preparation is a basic prerequisite for scoring.

(4) In attacking tactical cooperation, it is advisable to involve 3–4 players to avoid being caught by a quick counter-attack. Similarly, this principle can also apply to defensive tactics, but it should be adapted to the specific situation. At the same time, midfielders must both participate in attack and actively defend, so as to avoid disconnection between players in coordination.

(5) In training, tactical applications should be practised in a variety of different scenarios, seeking alternative techniques for the same tactics and increasing the diversity of goal-scoring zones and assist zones, making it harder for defenders to anticipate. Based on actual match analysis, observe the weak positions of defensive players and attack there to increase the probability of scoring.

(6) In training, more attention should be given to developing the individual technical and tactical abilities of promising players, enhancing their technical confidence, so that they dare to use their personal skills to create goal-scoring opportunities in matches. Improve their dribbling-breakthrough-and-shoot technique, create shooting chances, and enhance scoring ability.

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