Paper : Game Analysis

Comparative Analysis of Attack-related Game Aspects in the Japanese University Football League, Japanese J-League, and UEFA Champions League

Masao Nakayama[*], Midori Haranaka[**], Ryouta Sasaki[**], Yusuke Tabei[**], Teppei Kuwabara[***] and Yusuke Hirashima[**]

[*]Faculty of Health and Sport Sciences, University of Tsukuba
[**]Graduate school of Coaching Science, University of Tsukuba
[***]Toyo University Ushiku Senior High School
1-1-1 Tennodai, Tsukuba, Ibaraki 305-8574 Japan
nakayama@taiiku.tsukuba.ac.jp
[Received December 24, 2014; Accepted March 24, 2015]

The purpose of this study was to identify the characteristics of attack-related game aspects within three football leagues (JUL, JL, and CL).
The sample comprised 7,094 attacks, 4,839 of which were forward attacks (i.e., attacks that end near the opposing goal), and the data were collected from 30 matches in total (10 matches each from JUL, JL, and CL competition). The results revealed significant differences in attack time (JUL = 12.6 sec, JL = 13.7 sec, CL = 13.7 sec), forward attack time (JUL = 14.0 sec, JL = 15.7 sec, CL = 15.7 sec), number of successive passes (attack: JUL = 2.5, JL = 3.0, CL = 3.1; forward attack: JUL = 2.7, JL = 3.3, CL = 3.5), and pass tempo (number of passes / time: JUL = 0.19, JL = 0.21, CL = 0.22). In addition, there were significant differences between all three leagues in pass tempo during forward attacks (JUL = 0.18, JL = 0.20, CL = 0.21).
From these results, the characteristics of attack-related performance in different leagues were identified. Future studies should also consider the characteristics of defensive performance.

Keywords: Soccer, Coaching, Quantitative data, League comparison, Attack, Game aspects

[Football Science Vol.12, 58-66, 2015]

1. Objectives

Notational analysis is a representative method for the quantitative assessment of football games. While multilateral analysis of performance in football attacks has developed alongside the advancement of video devices, notational analysis has been utilized in coaching since the early investigations of Reep and Benjamin (1968). Notational analysis employs relatively simple variables such as the number of successive passes, shots, and goals.

Two major findings of Reep and Benjamin's (1968) studies on scoring in football were that nearly 80% of goals were scored after three or fewer successive passes and that one goal was scored for every 10 shots. These results showed that direct play, which is a simple attacking style in football, was an effective means of attack that influenced the selection of tactics in games (Bate, 1988). However, a number of teams in the present day rely on possession play, which involves more ball contact than direct play.

As a result, Hughes and Franks (2005) standardized the counting of successive passes and re-examined the correlation between shots and goals. They reported that successful teams attempted shots after a greater number of successive passes, and that the percentage of goals in relation to shots was higher in possession play than in direct play. Studies on possession play often adopt analytical methods that employ variables such as time, successive passes, and location (e.g., location where ball possession starts; Mahony et al., 2012). It is therefore common for data to be collected from televised game broadcasts or by staff of individual teams, both of which allow the applicable information to be utilized in coaching practice.

Indeed, Nakagawa (2010) has noted the importance of applying research findings to actual coaching, and that results are meaningless without such practical application. There are diverse ways that coaches can utilize game analyses, but a comparative review of matches at different levels of play can help identify current states as well as directions worth pursuing.

Such review is necessary for Japanese university football, as the role of university teams has become more important in the development of players.

To illustrate, 43% of the players selected by Japan Professional Football League (J-League) teams in 2012 graduated from university. Deguchi and Watari (2012) observed that because few youth players are brought onto J-League squads, one of the main sources of players is university football teams. This increases the importance of understanding the current state of university football players' performances through comparison with expected standards.

It is also meaningful to identify the state of Japanese football through comparison between J-League and world-class leagues. Many Japanese players who participated in the 2014 FIFA World Cup in Brazil are currently playing in European leagues, but it is impossible for all players to play overseas. Therefore, it is essential for the growth of Japanese football to improve the level of the J-League.

To date, however, no quantitative comparison of attacks within the Japanese University Football League, J-League, and European top league has been published. Comparisons are generally limited to coaches, critics, and journalists utilizing information distributed through the media.

For example, Ozawa (2013) makes reference to the comments of a scout employed by a European football club. In a comparison of games between the J-League and European leagues, the European scout reported that although J-League players seem to pass well at first glance, they in fact pass more in their own territory and that scoring opportunities are created by one long pass or swift attack. Accordingly, scoring is more often the result of defensive mistakes than a product of effective attacks. Comments such as this, when made by professionals, actually have a significant impact on football coaching. Nevertheless, although such qualitative information provides valuable assistance to coaches, it often includes personal impressions and opinions. Therefore, it is necessary to supplement this information with quantitative research data.

In response to the above, this study sought to identify the characteristics of attacking play within three leagues at different levels of competition — the Japanese University Football League (JUL), the Japanese professional J-League (JL), and the UEFA Champions League (CL). Specific comparisons were made of attacking zones, time, shots, goals, number of successive passes, and passing speed.

2. Method

2.1. Classification of Zones

The soccer pitch was divided into four zones: A1, A2, A3, and A4 (**Figure 1**). A1 extended from the team's goal line to the penalty area; A2 was from the team's penalty area to the half-way line; A3 was from the half-way line to the opponent's penalty area; and A4 covered the zone from the opponent's penalty area to the goal line.

Previous research has often divided the soccer pitch into three zones. Tenga et al. (2010), for example, analyzed data using the three-zone system, but there are no actual lines or markings on the pitch that clearly delineate the three areas. This is highly likely to cause dispersion in data measurements. Therefore, this study used lines clearly drawn on the pitch to divide it into four zones; a classification system that has also been used by Mahony et al. (2012). The international standard for football pitches is 68m × 105m, and the pitches in this study were all of this size. Thus, there were no differences among games in size of the different zones, which allowed for reproducibility of the data.

2.2. Definition of Terms

Takii (1995) defined two modes of play in football; namely, offense and defense. These terms are based, respectively, on possession and non-possession of the

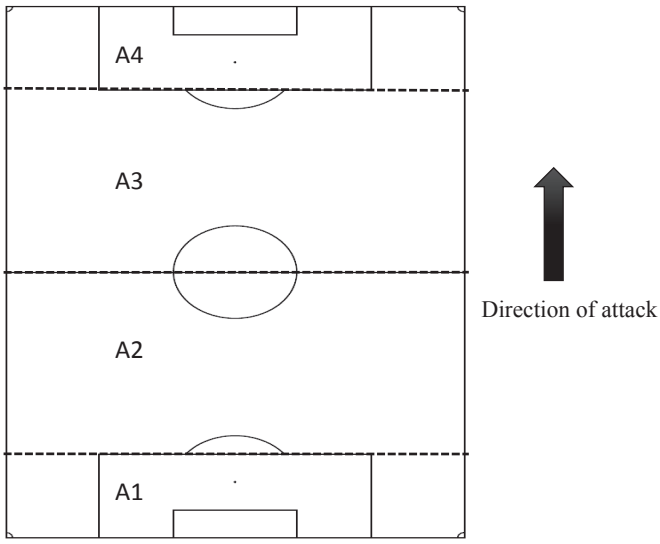

Figure 1 Pitch marking to determine field zones

ball and are used throughout the current study.

2.2.1. Attacking

The team that possesses the ball is on offense and the team that does not possess the ball is on defense. The attack runs between the time a team takes possession of the ball and the time the same team relinquishes it.

2.2.2. Start of Attack

The start of attack is defined as the time when the offense takes possession of a ball that has been put into play. However, the player who takes possession of the ball must make contact with it at least twice, either alone or in combination with another player on the same team.

2.2.3. End of Attack

The end of attack is defined as the time when the ball is put out of play (including scoring) or when a player on defense takes possession of the ball. However, it does not apply if the player who takes possession of the ball does not make contact with it at least twice, either alone or in combination with another player on the same team.

2.2.4. Forward Attack

An attack that starts in any of the four pitch zones and ends close to the opponent's goal is defined as a forward attack.

2.3. Samples

Data were obtained from 30 games, comprised of 10 games from the 2013 Kanto University League (JUL), 10 games from the 2013 J1 league (JL), and 10 games from the 2012-2013 UEFA Champions League (CL). This is shown in **Table 1**. Japanese university football is not played within a nationwide league. Therefore, the Kanto University League was used for the JUL data, as it is thought to be of a higher level than regional leagues. Teams in this league show slight deviation, but no significant deviation in mean attack time or mean number of successive passes per game was found. This led to the conclusion that the deviation would not have a strong impact on overall performance.

A total of 7,094 attacks were recorded on video and analyzed (2,721 in JUL, 2,196 in JL, and 2,177 in CL), with 4,839 forward attacks extracted from the total (1,854 in JUL [68%], 1,499 in JL [68.2%], and 1,486 in CL [68.3%]). This number was considered sufficient for a comparison of variables

Table 1 List of analyzed matches and scores, number of corner kicks, number of free kicks, mean attack time and mean number of passes

	1st	2nd	Total	shots	conor kicks	free kicks	mean attack time	mean number of passes
2013 Kanto University League Soccer								
Toin Yokohama vs Ryutsukezai	1-0	2-1	3-1	12-12	3-2	18-14	11.5	2.1
Juntendo vs Ryutsukezai	0-0	0-0	0-0	3-9	5-6	13-17	10.7	1.9
Sensyu vs Ryutsukeiza	0-2	2-1	2-3	9-19	9-6	21-15	10.6	1.7
Tsukuba vs Toin Yokohama	1-0	0-0	1-0	12-4	10-2	21-18	12.7	2.5
Tsukuba vs Keio	0-0	3-0	3-0	13-6	10-4	20-17	14.6	2.8
Tsukuba vs Sensyu	0-0	1-2	1-2	12-20	5-5	21-13	13.4	2.7
Chuo vs Waseda	1-1	0-1	1-2	5-12	4-8	6-12	14.0	2.6
Toyo vs Nippon Taiiku	1-3	0-3	1-0	3-9	1-4	17-20	12.8	2.3
Nippon Taiiku vs Meiji	0-0	0-0	0-0	8-9	3-9	18-21	12.2	2.3
Meiji vs Waseda	0-1	1-1	1-2	8-8	6-7	11-12	13.4	2.4
2013 J. league division 1								
Nagoya vs Iwata	1-0	0-1	1-1	10-18	2-7	10-16	15.6	3.2
Hirosima vs Urawa	0-1	1-1	1-2	7-9	6-2	24-16	14.0	3.3
Shimizu vs Yokohama	0-2	0-3	0-5	3-13	2-2	15-15	12.5	2.6
Yokohama vs Tokyo	0-1	3-1	3-2	8-11	3-6	16-18	12.7	3.0
C Osaka vs Sendai	0-1	1-0	1-1	10-10	2-2	6-9	18.2	3.7
Kashima vs Koufu	0-0	0-0	0-0	23-10	3-2	18-8	13.8	3.2
Kawasaki vs Nagoya	1-0	1-1	2-1	15-15	6-5	10-13	13.2	2.9
Oita vs Tosu	1-1	1-3	2-4	6-21	3-6	16-14	10.3	2.2
Nigata vs Kasiwa	0-0	3-2	3-2	14-11	7-13	17-13	11.9	2.6
Sendai vs Shounan	0-0	0-0	0-0	11-10	6-2	16-18	15.8	3.2
2012-13 UEFA Champion league								
Galatasaray vs Schalke	1-1	0-0	1-1	13-12	3-6	19-14	11.9	3.1
Barcelona vs Benfica	0-0	0-0	0-0	9-18	2-10	22-4	14.6	3.1
Valencia vs PSG	0-2	1-0	1-2	12-14	8-0	10-13	14.4	3.3
Shakhtar vs Dortmund	1-1	1-1	2-2	8-17	4-6	15-10	12.3	2.7
Arsenal vs Bayern	0-2	1-1	1-3	12-16	2-8	19-13	17.2	4.0
Porto vs Malaga	0-0	1-0	1-0	17-1	11-2	16-13	11.3	2.6
Juventus vs Celtic	1-0	1-0	2-0	8-14	1-3	15-14	15.8	3.4
Manchester United vs Real Madrid	0-0	1-2	1-2	18-21	9-12	10-7	14.1	3.0
Barcelona vsPSG	0-0	1-1	1-1	10-9	7-5	14-11	12.4	2.6
Dortmund vs Bayern	0-0	1-2	1-2	12-14	6-8	6-10	12.4	2.6

associated with average attacking play in each league. Recordings were made by digital video camera from satellite broadcasts.

2.4. Measurement Method

The recordings were replayed and paused to isolate each aspect of games, and measurements were taken of the items shown below.

2.5. Measurement Items

2.5.1. Shots and Goals

All shots and the results of those shots were examined.

2.5.2. Start Zone of Attacks

The zone on the pitch in which each attack started was identified.

2.5.3. End Zone of Attacks

The zone on the pitch in which each attack ended was also identified.

2.5.4. Attack Time

Using the frame feed reproduction function, the time between the start and end of attacks was calculated by measuring the associated number of video frames.

2.5.5. Number of Successive Passes

The number of successive passes was categorized as 0 to 10 and 11 or more.

2.5.6. Pass Tempo

Pass tempo was calculated by dividing the number of successive passes by attack time.

2.6. Measurement Reliability

Two students studying football coaching at the master's level were engaged in taking the measurements by pausing and replaying videos repeatedly. The two students took their measurements separately.

Reliability of the measurements was evaluated by examining 435 attacks by both teams in two games that were randomly extracted from the 30 games of the overall sample. Calculations were made of the interclass correlation coefficient for attack time (which is a continuous variable) and the *k* variable for the three items of start zone of attacks, end zone of attacks, and the number of successive passes (which are category variables). As a result, the interclass correlation coefficient for attack time was 0.98, and the *k* variables were 0.994 for start zone of attacks, 0.893 for end zone of attacks, and 0.864 for the number of successive passes. The mean variable was 0.990, which showed that the measurements were reliable.

2.7. Statistical Processing

The Chi-squared test was used to analyze the presence or absence of shots and goals in all attacks, as well as the difference in frequency of appearance between each start zone and end zone of attacks. One-way ANOVA was used to compare mean attack time, mean pass sequence, and mean pass tempo among the three groups. Two-way ANOVA was used to examine the correlation between the zones and the three groups at mean pass tempo in forward attacks. The statistical significance level was set at .05. IBM SPSS Statistics ver.21 was used for the statistical processing of all data.

3. Results

3.1. Shots and Goals

The comparison of presence or absence of shots and goals in all attacks (**Table 2**) among the three

Table 2 Attacks, shots, and goals

	JUL	JL	CL
Total number of attacks	2,721	2,196	2,177
Total number of shots	203	190	200
Ratio of shots ((shots／attack)*100) %	7.5	8.7	9.2
Goal scores	22	29	23
Ratio of goal scores((scores／shot)*100) %	10.8	15.3	11.5

groups revealed no significant differences ($\chi 2$ = 8.209, df = 4, p = .08).

The ratio of attacks that led to shots was 7.5% in JUL, 8.7% in JL, and 9.2% in CL. The ratio of goals to shots was 10.8% in JUL, 15.3% in JL, and 11.5% in CL.

3.2. Start Zone and End Zone of Attacks

The frequency of appearance of each start zone and end zone of attacks was also measured (**Table 3**), and the results of Chi-squared testing revealed a significant difference in the start zone of attacks ($\chi 2$ = 14.677, df = 6, p < .05). Specifically, the results of sub-effect tests revealed a significant difference between JL and CL ($\chi 2$ = 14.677, df = 6, p < .05). However, the end zone of attacks showed no significant difference among the three groups ($\chi 2$ = 3.086, df = 6, p > .05).

The ratio of start and end zone of attacks in each group is shown in **Figure 2**.

3.3. Attack Time

Comparing the mean attack time of the three groups (**Table 4**) revealed times of 12.6 sec for JUL (*SD* = 10.5), 13.7 sec for JL (*SD* = 12.9), and 13.7 sec for CL (*SD* = 12.8). One-way ANOVA showed a significant difference (F = 7.528, df = 2, p < .01), and the results of multiple comparisons by Tukey's HSD method revealed a significant difference of 1% between JUL and JL, and between JUL and CL. However, no significant difference was observed between JL and CL.

3.4. Number of Successive Passes

The number of successive passes was 2.5 in JUL (*SD* = 2.7), 3.0 in JL (*SD* = 3.0), and 3.1 in CL (*SD* = 3.1). This is shown in **Table 4**. One-way ANOVA revealed a significant difference (F = 25.72, df = 2, p < .01), and the results of multiple comparisons by

Table 3 Frequency of start and end zones in all attacks

league	start zone				χ^2-test
	A1	A2	A3	A4	
JUL	673	1202	651	200	χ^2 = 14.677, df=6, P < .05
JL	592	937	514	153	difference
CL	505	1010	480	182	JL × CL χ^2 = 13.228, df=3, P < .01

league	end zone				χ^2-test
	A1	A2	A3	A4	
JUL	37	530	1277	882	χ^2 = 3.086 df=6, n.s.
JL	39	428	999	730	
CL	32	404	1015	726	

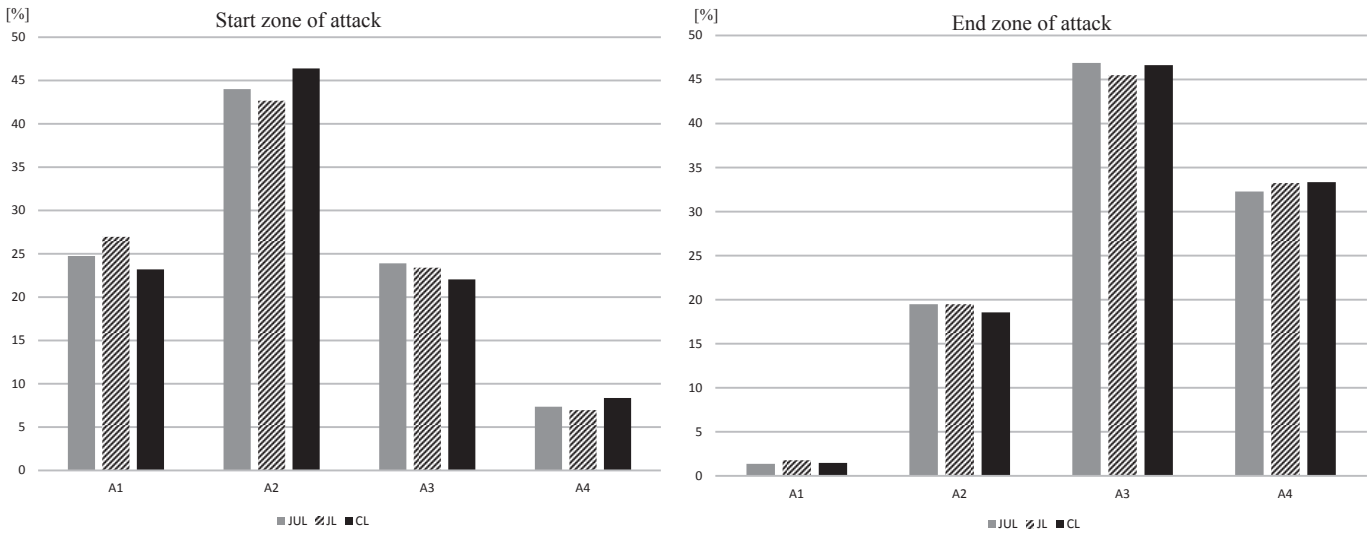

Figure 2 The histogram of start and end zone of attack

Table 4 Mean attack time (sec.), mean pass sequence (time) and mean pass sequence (time) in each attack and league

All attacks	League				
	JUL	JL	CL	ANOVA	difference
Mean attack time (sec.)	12.6(10.5)	13.7(12.9)	13.7(12.8)	*df=2 F=7.528 p<.01*	*JUL < JL,CL p <.01*
Mean pass sequeence (time)	2.5(2.7)	3.0(3.0)	3.1(3.1)	*df=2 F=25.720 p<.01*	*JUL < JL,CL p <.01*
Mean pass tempo (sec/time)	0.19(0.14)	0.21(0.15)	0.22(0.16)	*df=2 F=31.923 p<.01*	*JUL < JL,CL p <.01*
			(S.D)		
Forward attacks	League				
	JUL	JL	CL	ANOVA	difference
Mean attack time (sec.)	14.0(10.9)	15.7(13.7)	15.7(13.2)	*df=2 F=10.578 p<.01*	*JUL < JL,CL p <.01*
Mean pass sequeence (time)	2.7(2.8)	3.3(3.2)	3.5(3.3)	*df=2 F=30.312 p<.01*	*JUL < JL,CL p <.01*
Mean pass tempo (sec/time)	0.18(0.13)	0.20(0.13)	0.21(0.13)	*df=2, F=35.426 p<.01*	*JUL < JL < CL p <.01*
			(S.D)		

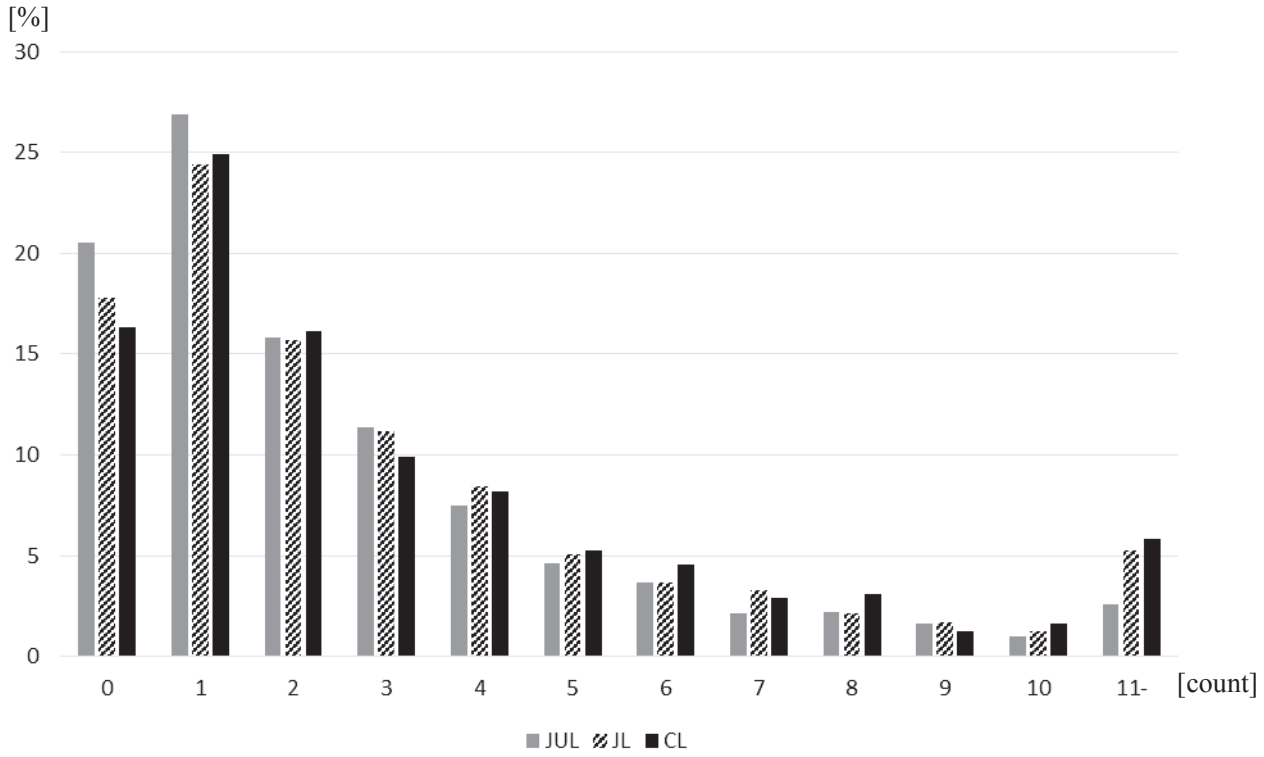

Figure 3 The histogram of the number of passes

Tukey's HSD method demonstrated a significant difference of 1% between JUL and JL, and between JUL and CL. However, no significant difference was observed between JL and CL.

Furthermore, the mean pass sequence in forward attacks was 2.7 passes in JUL (*SD* = 2.8), 3.3 in JL (*SD* = 3.2), and 3.5 in CL (*SD* = 3.3). One-way ANOVA revealed a significant difference ($F = 30.31$, $df = 2$, $p < .01$), and the results of multiple comparisons by Tukey's HSD method showed a significant difference of 5% between JUL and JL, and between JUL and CL. However, no significant difference was observed between JL and CL.

The number of successive passes was also categorized as 0 to 10 and 11 or more. The frequency is shown as a histogram in **Figure 3**.

3.5. Pass Tempo

Mean pass tempo in attacks was 0.19 in JUL (*SD* = 0.14), 0.21 in JL (*SD* = 0.15), and 0.22 in CL (*SD* = 0.16). This is illustrated in **Table 4**. One-way ANOVA

revealed a significant difference ($F = 31.923$, $df = 2$, $p < .01$), and the results of multiple comparisons by Tukey's HSD method demonstrated a significant difference of 1% between JUL and JL, and between JUL and CL. However, no significant difference was observed between JL and CL.

Furthermore, the mean pass tempo in forward attacks was 0.18 in JUL ($SD = 0.13$), 0.21 in JL ($SD = 0.13$), and 0.21 in CL ($SD = 0.13$). One-way ANOVA revealed a significant difference ($F = 35.426$, $df = 2$, $p < .01$), and the results of multiple comparisons by Tukey's HSD method produced a significant difference of 1% between JUL and JL, and between JUL and CL.

To examine the results in more detail, the forward attacks in each start and end zone were classified into six categories (A1A2, A1A3, A1A4, A2A3, A2A4, A3A4). Mean pass tempo in each category is shown in **Figure 4**. Two-way ANOVA was conducted for 3 leagues and 6 categories in each start and end zone, and the results revealed a significant interaction effect (League × Start and End Zone, $df = 10$, $F = 20.30$, $p < .05$). Therefore, simple main effects for each factor were examined. A significant simple main effect was associated with zones in all leagues. That is, zones A1A2, A1A3, A2A3 and A2A4 revealed a significant simple main effect associated with league, and the results of multiple comparisons showed that JUL was significantly slower than JL and CL in A1A2; JUL was the slowest, followed by JL and CL in A1A3; JUL was significantly slower than JL and CL in A2A3; and JUL was significantly slower than JL in A1A3.

4. Discussion

No significant differences were observed in frequency of attacks, shots, and goals among JUL, JL, and CL. This indicates that the relationship between these aspects of football games has not changed significantly since the time of Reep and Benjamin (1968). However, it is possible that the efficiency of attacks has increased alongside overall improvements in players' abilities. At the same time, competition in league matches often involves teams of similar levels, which raises the further possibility that defensive ability has improved in conjunction with improvements in attacking skills. Therefore, it is necessary to consider the notion that significant changes in the efficiency of attacks may not be readily apparent, which necessitates more detailed examination through data extraction and analyses.

More than 40% of all attacks in JUL, JL, and CL started in A2, and more than 45% ended in

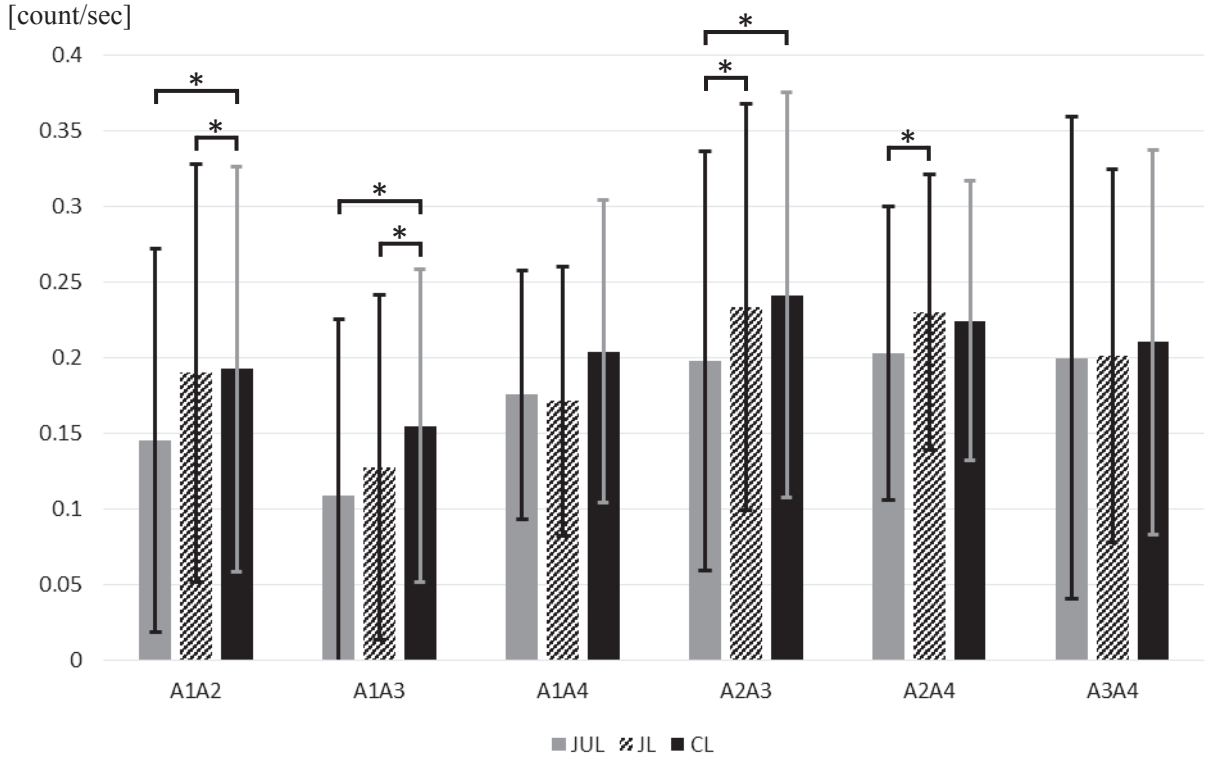

Figure 4 Pass-tempo of forward attack in each zone (Error bar shows standard deviation. *p<0.05)

A3. This means that in the three leagues, a lot of competition for possession took place in the middle zones. Considering the relationship between the start and end zones of attacks, approximately 68% of all attacks were forward attacks. The start zone of attacks also showed a significant difference between JL and CL in that more JL attacks started in front of goal in the team's own territory (A1). This result may not be sufficient for interpretation, but it perhaps shows a general tendency within JL games.

Mean pass sequence, mean attack time, and mean pass tempo were compared as well. While the number of successive passes and attack time alone cannot be used to evaluate the quality of attacks, some studies have examined the effectiveness of possession style (Collet, 2012). To that end, Tenga et al. (2010) reported that higher-ranked teams use possession attacks to throw the opposition off balance, which leads to shots and goals. In other words, longer attack times with successive passes are associated with higher skill.

Against this backdrop, JUL revealed a significantly lower mean pass sequence and lower mean attack times than JL and CL. As seen in the histogram for number of successive passes, the ratio of more than 11 successive passes in JUL was lower than in JL and CL; and the ratio of no passes or one pass in JUL was higher than in JL and CL. This clearly indicates that JL and CL were superior to JUL in keeping possession of the ball.

In addition, pass speed was thought to be an important index for the evaluation of attack performance, but it is difficult to measure pass speed during games. Therefore, the number of successive passes was divided by attack time — subsequently defined here as pass tempo — and used as the corresponding evaluation index. This approach is corroborated by Shoji (2014), who reported that the German national team (winner of the 2014 FIFA World Cup in Brazil) set individual player goals of moving the ball around rather than holding it for long periods of time. This caused mean time of ball possession per player to drop from 2.8 seconds to less than 1 second at the 2006 FIFA World Cup in Germany. Ball possession is seen as an important consideration, but it is equally important to improve players' abilities to pass as frequently as possible (Anderson & Sally, 2013). Thus, pass tempo was used as an index for evaluating the level of performance, with the implication that the faster the pass tempo becomes, the higher the level of performance.

Mean pass tempo in all attacks in JUL was significantly lower than in JL and CL, while no significant difference was observed between JL and CL. Mean pass sequence and attacking time in forward attacks in JUL were also significantly different from JL and CL, but again, no significant differences between JL and CL emerged.

However, comparison between the three groups regarding pass tempo in forward attacks showed that CL was significantly faster than JL, and that JUL was the slowest among the three. To examine these results in more detail, forward attacks were classified according to six categories for the start and end zones of attack (A1A2, A1A3, A1A4, A2A3, A2A4, A3A4). The pass tempo in each category was also assessed, and revealed a difference in A1A3 between JL and CL (Figure 4). A1A3 is associated with attacks from the front of the team's own goal to the middle of the opponent's zone, and this finding suggests differences between JL and CL in pass tempo from the former to the latter zone. It also supports Ozawa's (2013) comment that "Although players seem to pass well at a glance, they in fact pass more in their own territory", which points to insufficient speed in advancing the ball forward.

Thus, it was found that JUL, JL, and CL showed no significant differences in shots, goals, or start and end zones of attack. However, JUL was significantly different from JL and CL in attacking skills as indicated by pass sequence and attacking time. Moreover, JL and CL showed differences in forward attack tempo from the team's own territory to the opposing team's zone.

5. Conclusion

Quantitative analysis of football attacks in JUL, JL, and CL games illustrated differences in performance within the three leagues. Especially noteworthy were differences between JL and CL in skills associated with pass tempo during attacks from the team's own territory to the opponent's area. These differences in pass tempo outline aspects of performance that should be addressed if more Japanese footballers are to reach world-class levels of play.

Japanese university coaches as well as coaches of J-League teams tend to focus on competition in their domestic leagues and tournaments. However, it is necessary for coaches in Japan to be aware of

the features of high-level performance in European leagues and to clearly understand the state of their own teams. Furthermore, while the current study was carried out to examine attacks in games, follow-up research should also consider defensive aspects of performance.

Reference

Anderson, C. and Sally, D. (2013) The numbers game why everything you know about soccer is wrong. Penguin books, N.Y.

Bate, R. (1988) Football chance: tactics and strategy. In: Reilly, A. et al. (Eds.) Science and Football. E & FN Spon: London, 293-301.

Collet, C. (2012) The possession game? A comparative analysis of ball retention and team success in European and international football, 2007-2010.

Deguchi, K. and Watari, T (2012) A study on patterns of the carrier choice in J League. Tokuyama University Bulletin,76:119-136. (in Japanese)

Hughes, M. and Franks, I. (2005) Analysis of passing sequence, shots and goals in soccer. Journal of Sport Science, 23(5): 509-514.

Mahony, L.E., Wheeler, K.W. and Lyons, K. (2012) Analysis of factors determining invasion into attacking areas and the creation of goal-scoring opportunities in the Asian cup football competition. Asian Journal of Exercise & Sports Science, 9(1): 53-66.

Nakagawa, A. (2011), A review of studies using notational analysis of game performance in rugby union football. Bull. Inst. Health & Sport Sci. Univ. of Tsukuba. 34 1-16 (in Japanese)

Ozawa, I. (2013) The difference in between J-League and world level that felt by a scout. Sportsnavi. (http://sportsnavi.yahoo.co.jp/sports/soccer/jleague/2013/columndtl/201305150001-spnavi) (in Japanese)

Reep, C. and Benjamin, B. (1968) Skill and chance in association football. Journal of the Royal Statistical Society, A, 131: 581-585.

Shouji, S. (2014) You cannot win in the system in football New strategy era by data. Best Shinsyo, Tokyo. (in Japanese))

Takii, T. (1995) Tactics in world football. Baseball magazine, Tokyo. (in Japanese))

Tenga, A., Ronglan, L.T. and Bahr, R. (2010) Measuring the effectiveness of offensive match-play in professional soccer. European Journal of Sport Science, 10(4): 269-277.

Name:
Masao Nakayama

Affiliation:
Faculty of Health and Sport Sciences, University of Tsukuba

Address:
1-1-1 Tennodai, Tsukuba, Ibaraki 305-8574 Japan

Brief Biographical History:
1989- Lecturer, Faculty of education, Nagasaki University
2008- Associate Professor, Faculty of Health and Sport Sciences, University of Tsukuba

Main Works:
- Effects of the different stage of development of players and play area size as a task constraint on soccer pass skills. Japan J. Phys. Educ. Hlth sport Sci., 54: 343-353, December, 2009.
- The effects of play area size as task constraints on soccer pass skills. Football Science, 5, 1-6, 2008.

Membership in Learned Societies:
- Japan Society of Physical Education, Health and Sport Sciences
- Japanese Society of Science and Football