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Analysis of the Effectiveness of Back Attack Positions for Male Athletes in the Indonesian Professional Volleyball League

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Abstract This study aimed to analyze the success rate of back attacks from three different positions (left, center and right). This study used a quantitative research design to analyze the back attacks performed by a group of male volleyball athletes at the 2024 Proliga (the Indonesian professional volleyball competition). We observed 24 matches from the final matches of four teams of the 2024 Proliga. The research was conducted using a survey method with systematic observation techniques on 24 matches from the four final teams of the 2024 Proliga. The total sample included 656 back attacks analyzed using a set of validated observation instruments. The results showed that the attacks from position 8 (center) had the highest success rate with a percentage of 82.13%. The second most successful attacks were conducted at position 9 (right) with a percentage of 68.44%. In contrast, back attacks performed from the position 7 (left) scored a success rate of 37.24%. Statistical analysis showed $p<0.05$, indicating a significant difference among attacks carried out from the three positions. Higher success from the middle position is associated with various factors such as wider angles of attack, shorter ball travels, and difficulties in blocking opponents while reading the direction of attacks. The correct position ranked second because it had the advantage of sharp attack angles. In contrast, the left position has the lowest success rate due to the limitations of attack angles, making it easier for the opponent's defense to read. The results of this research can be used to develop better strategies for volleyball matches, especially related to the improvement of back attacks among the volleyball athletes. The results of this study imply the need to improve the effectiveness of back attacks and design training programs that can enhance the quality of back attacks, especially in the context of Indonesian volleyball teams.

Keywords Attacking Position, Back Attack, Indonesian Professional League, Male Athletes, Volleyball

1. Introduction

The use of back attacks in volleyball matches can be an important determinant that improves the games, making a deep analysis of strategies to perform effective back attacks. Volleyball is one of the most popular team sports in the world as it is played by approximately 800 million players around the world [1,2]. The popularity of volleyball

has also reached Indonesia as a survey mentioned that volleyball is the third most watched sport in Indonesia [3]. Due to its high recognition among Indonesians, there is an annual volleyball event called Proliga (professional league) which is held by the Indonesian Volleyball Federation (PBVSI). This event is considered as one of the most important volleyball events in Indonesia as it includes top teams from all over Indonesia. As volleyball grows more popular, it seems important to analyze suitable strategies to enhance the quality of athletes and ensure the winnings. In this regard, the development of modern volleyball requires more complex and compelling variations of attacks to be able to win matches. One of the variations of attack that can make a drastic change in modern volleyball games is a back attack or an attack performed from the back position [4]. Furthermore, this attack was carried out from the area behind the back line, precisely from positions 7 (left), 8 (center), and 9 (right). In this sense, the back attack is an important element in the attacking strategy of elite volleyball teams because this particular attack provides an additional dimension in attack variation and allows the team to maximize the potential of the defenders. The uniqueness and effectiveness of the back attack lie in its ability to surprise the opponent's defense because it is carried out from an unconventional position [5]. Due to the importance of performing back attacks during the volleyball matches, analyzing the success of back attacks seems important to improve the performance of teams. The results of a study by Carrión et al. indicate that back attacks contributed to 25-30% of the total points in a match [6]. It can be concluded that the back attacks are important parts of the modern volleyball games because they can be used to enhance the volleyball matches. The next paragraph will explain the studies that investigate the use of back attacks in volleyball matches.

Several studies have investigated back attacks in volleyball matches. A study of Bujang and Haqiyah [7] on the effects of power, flexibility and the ability of volleyball athletes to perform back attacks suggests that the strengths of leg muscles and arm muscles as well as the athletes' flexibilities and self-control can determine the quality of back attacks. Besides that, Chun and Shin [8] investigate the effective defenses for men's volleyball games through the analysis of kinematic factors like spike position, attack direction and defender's position while performing back attacks. Additionally, the results of Drikos et al.'s [9] study on the relationships among the performances of passing, the spatiotemporal characteristics of offensive actions and the types of opponents' blocking toward the performances of outside hitters indicate the significant improvements in team scores when the athletes executed various back attacks. Against this background, numerous aspects such as timing, the coordination with setters, the quality of ball passing, the angles of attacks, the availability of the attacks as well as the players' abilities to read their opponents' blocking can contribute to the quality of back attacks during the volleyball matches [10, 11]. Furthermore, it has been argued that position 8 (center) is considered as the most advantageous position for back attacks because this position provides flexibility to direct attacks and create havoc on the opponents' defenses [12]. Regarding position 9 (right), the findings of Mocanu et al.' [12] research on the efficiencies of attacks and errors based on the value level of teams in the competitive system suggest that position 9 (right) can create sharp angles for back attacks whereas position 7 (left) frequently encounters more difficulties when handling opponent blocks. The aforementioned results were possible due to the improvements in match analysis technology that allow a deeper evaluation of the effectiveness of attacks during volleyball matches [13], assisting the analysis of factors that can influence the success of back attacks from various positions in a volleyball match. In terms of tactical aspects of the executions of back attacks, the timing of attacks and the variations in positions can affect the chances of the opponents to anticipate and block the attacks [14]. Thus, understanding the right strategies to choose an attack position might increase the chances to score and execute effective attacks. Therefore, conducting an in-depth analysis of the effectiveness of back attacks from various positions seems important to help volleyball teams improve their performances during the volleyball matches [15]. In regard to the significance of attacking positions to the success of back attacks, a study of Mitrotasios et al. [16] on the opportunities of goal scoring in the top four European football leagues shows that the positions of attacks can dramatically impact the results of a particular match. It can be said that the positions of attack have a direct influence on the performance of a team, particularly in volleyball matches. Despite the aforementioned results, there is a dearth of studies that analyze the effectiveness of back attacks executed from various positions, especially in the context of professional volleyball matches in Indonesia. Such a study can provide better insights into the effectiveness of back attacks from different positions, helping the volleyball teams to optimize their offense strategies and improve their overall performances during the competitions. Hence, we aim to analyze the success rate of back attacks from positions 7 (left), 8 (center), and 9 (right).

2. Materials and Methods

This section aims to describe the research design, the research subjects and the research instruments of this study.

2.1. Research Design

The present study applied a quantitative research design. Against this background, the objective of quantitative research design is to understand social phenomena through quantifiable variables and data, intended for testing hypotheses, creating predictive models, or drawing

conclusions about causality [17]. We chose this particular research design because it is able to provide a comprehensive overview of the effectiveness of the back attack from various positions in the actual match situation. In order to ensure the validity of the results, the observations would be made without any manipulations or interventions toward the variables investigated. We recorded the volleyball matches and watched them several times. We also conducted an inter-rater reliability test to ensure the validity and reliability of the analysis.

2.2. Research Subjects

This study applied a purposive sampling technique that refers to a deliberate selection of the research subjects according to their capacity to clarify a particular phenomenon, idea or theme [18]. Although this sampling technique might not entirely represent the whole population [19], we opted for this sampling technique because it allows us to select the specific samples from the population that we would investigate according to the topic of our research. Since the purpose of this study was to examine the success rate of back attacks during the volleyball matches, we used the following criteria to choose the research participants: (1). The volleyball team should be one of the best volleyball teams in Indonesia; (2). The particular volleyball team should be one that frequently uses back attacks during their matches. Thus, we chose four all-male volleyball teams that competed in the 2024 Proliga as they suited our criteria the best. Those teams are Bhayangkara Presisi, LavAni Allo Bank Electric, STIN BIN and Palembang Bank Sumsel Babel. Before we conducted the observation, we asked the permission from the organizers of the 2024 Proliga and the volleyball teams we observed. We provided an ethical form to ensure the research subjects that the information they provided would only be used for the purposes of this study and to ensure the anonymity of the research subjects. In order to provide a comprehensive analysis for this study, we recorded and analyzed a total of 24 volleyball matches of the aforementioned teams during the 2024 Proliga.

2.3. Research Instruments

We applied a structured observation sheet to analyze the research subjects. In order to ensure the validity and the reliability of that particular research instrument, we conducted a pilot test. We used three criteria (point, the continuation of rally and error) in the observation sheet. We recorded and analyzed six volleyball matches in the preliminary round of the 2024 Proliga. The results of the pilot study showed a reliability level of 0.813 and a Cronbach' alpha of 0.733. In addition, we performed an inter-rater reliability test among the researchers of this study to ensure the consistency of the rating system among the observers. In this regard, an inter-rater reliability test can be defined as the consistency when different people measure the same phenomenon, highly related to the instrument used to obtain the measurements [20]. We used Cohen's kappa (k) to measure the inter-rater reliability. Next, we conducted the inter-rater reliability by measuring the number of times multiple raters have the same opinions on a measurement of observation. The results of the inter-rater reliability show the percentage of the inter-reliability of 0.977 and the Kappa is 0.80, indicating a relatively high inter-reliability among the observers.

Table 1 shows the criteria for the counter-attack success observation sheet with the criteria that if there is an error, it will get a value of 0, rally proceed will get esteem of 2 and points will get a value of 4.

Table 1. The Criteria of Observation Sheet of Back Attack's Success

Criteria	Value
POINT The ball is immediately deadly, and the opponent cannot return the ball.	4
RALLY CONTINUE The ball can be returned to the opponent, and the rally continues.	2
ERROR Ball off the field, Ball in net, and Rotation or offensive line violation.	0

2.4. Data Collection Procedure

Following are the stages we applied in this study:

1. **The preparatory stage** consisted of preparing and conducting a pilot study for the research instruments, delivering a training program for the observers of the volleyball matches, and securing the permissions from the organizers of the 2024 Proliga and the representatives of the volleyball teams.
2. The i**mplementation stage** of this study involved making a direct observation of the volleyball matches, recording the volleyball matches for further analysis, analyzing the recorded volleyball matches using the observation sheets, and verifying data among the researchers.
3. **The analysis stage** of this study included tabulating the observed data, verifying the completeness and accuracy of data, and processing the statistical data.

Figure 1 is the zone where the success score in carrying out the athlete's Back Attack attack is divided into 3 attack zones and the score value of each zone is different, namely scores 1, 6, 5 are in zone 3, scores 7, 8, 9 in zone 2 and scores 2, 3, 4 in zone 1.

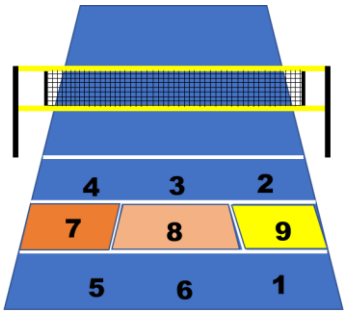

Figure 1. The field and the athlete's back attack zone

2.5. Data Analysis

The collected data was analyzed using descriptive and inferential statistical methods with the help of SPSS (Statistical Package for the Social Sciences) 26. Following are the descriptions of the descriptive and inferential statistics we applied for this study:

1. Descriptive statistics include the calculation of the frequencies and percentages of the success of the back attacks, the effectiveness of the average back attacks, and the distributions of the results of the back attacks.
2. Inferential statistics consist of the data normality test using Kolmogorov-Smirnov, the variance analysis (ANOVA) to compare the effectiveness of attacks from three different positions and a Tukey HSD post-hoc test to determine the specific differences among the positions of the back attacks with the significance level set at $p<0.05$.

3. Results and Discussions

In order to present a better organization, we would describe the results before discussing them. Next, the results are divided into the descriptions of the success rate of the back attacks to score, the average number of back attacks, and the effectiveness of the back attacks.

Looking at table 2, it can be seen that 82.13% of the success of the back attacks were executed from the center position (8). The second most successful back attacks, accounting for 68.44%, were performed from the right position (9). The least successful back attacks, comprising 37.24% of the success rate, were found when the players made back attacks from the left position (7), [see figure 2].

Table 2. The Success Rate of Back Attacks According to the Players' Positions

Position	Number of Attacks	The Percentages of Back Attacks' Success
Position 7 (left)	196	37.24%
Position 8 (central)	235	82.13%
Position 9 (Right)	225	68.44%

According to table 3, the results of Tukey post hoc test show a significant difference between the 7 and 8 positions ($p<0.001$) and similarly the 8 and 9 positions indicate $p<0.002$, a relatively high difference in terms of the average back attacks. In addition, the difference between the 7 and 9 positions is $p<0.001$, a quite significant result.

Table 4 shows that the back attacks performed from the right position (8) scored the highest effectiveness of 3.21. Subsequently, the back attacks executed from the 9 position indicate the average effectiveness of 2.22 while the least effective back attacks were found from the 7 position with the average effectiveness of 1.11, [see figure 3].

Table 5 shows the results of a one-way ANOVA on the average effectiveness of counterattacks, revealing a statistically significant difference of $p<0.01$.

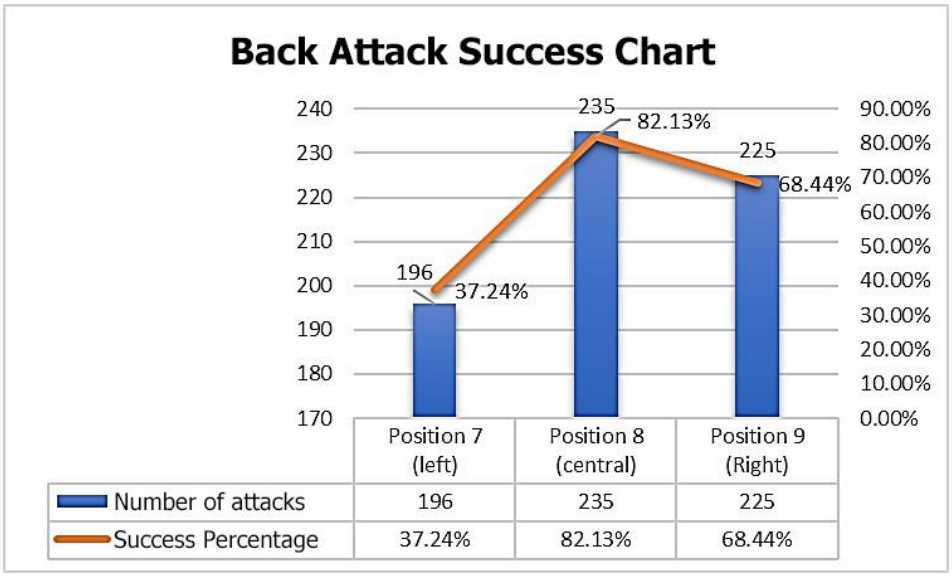

Figure 2. Back Attack Success Chart

Table 3. Tukey Post-hoc Test – Mean Back Attack

		Position 7 (left)	Position 8 (central)	Position 9 (Right)
Position 7 (left)	Mean difference	-	-44.9	-31.0
	p-value		<0.001	<0.001
Position 8 (central)	Mean difference		-	13.8
	p-value			0.002
Position 9 (Right)	Mean difference			-
	p-value			

Table 4. The Effectiveness of Back Attacks Based on the Positions of Players

Position	Average Effectiveness
Position 7 (left)	1.11
Position 8 (central)	3.21
Position 9 (Right)	2.22

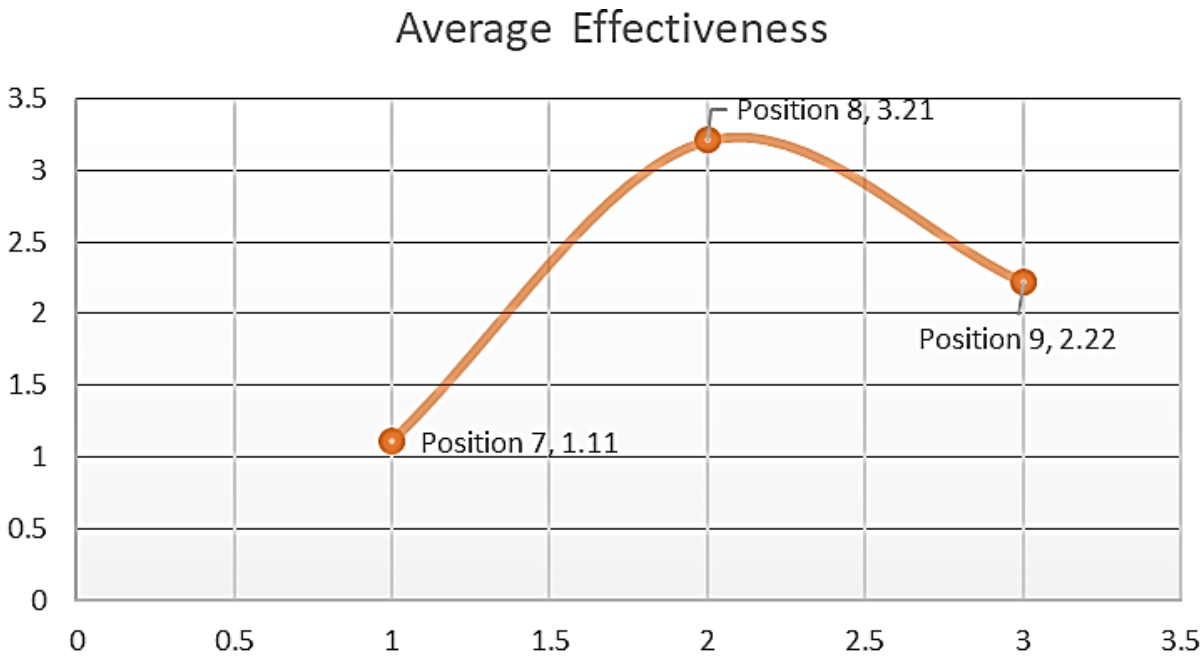

Figure 3. Average effectiveness graphs

Table 5. One-way ANOVA (Welch's)

	F	df1	DF2	p
Back Attack	96.5	2	429	<0.001

Table 6. Tukey Post-hoc Test – Mean Back Attack

		Position 7 (left)	Position 8 (central)	Position 9 (Right)
Position 7 (left)	Mean difference	-	-2.10	-1.110
	p-value		<0.001	<0.001
Position 8 (central)	Mean difference		-	0.991
	p-value			<0.001
Position 9 (Right)	Mean difference			-
	p-value			

Table 6 shows that the Tukey post hoc test revealed a significant difference between the 7 and 8 positions (-2.10, $p<0.01$). Similarly, table 6 suggests that the 8 and 9 positions were found to be drastically different (0.991, $p<0.001$). In addition, the difference between the 7 vs 9 positions was found to be prevalent (-1,110, $p<0.001$).

4. Discussion

The results of this study showed that the back attacks performed from the center position (8) had the highest success and effectiveness rate among the three positions. The findings of this study are similar to the outcomes of a previous study that indicates the prevalence of the center position to score the effective back attacks during the volleyball matches [21]. Nevertheless, the outcomes of Cantú-González et al. [22] indicate factors such as the width of the angles of the back attacks (the players from the center position have an option to direct attacks to various positions of the opponents' side and make it difficult for the opponents to read and block the back attacks), the relatively short ball travel (the back attacks from the center position have a shorter ball trajectory from the edge position, giving the opponents less time to react), and the opponents' blocking difficulties (the opponents' blocking formations often make it difficult to anticipate and repel the back attacks from the center position especially when the back attacks are combined with a variety of passes) [23].

Additionally, the outcomes of this study indicate the right position (9) as the second most successful position in terms of the execution of effective back attacks during the volleyball matches. Considering this, the right position (9) is considered as advantageous because this position gives the players a possibility to execute a back attack with a sharp angle that forces their opponents to change the blocking formation and gives more chances for the players to move to the right position (9) [24]. The findings of this study also suggest that the left position (7) is shown to be the position that creates less impact in terms of the effectiveness of the back attacks. Several limitations are attributed to the fewer chances of a player to score an effective back attack from the left position (7). Firstly, the players from the left position have limited options to direct their attacks, making it easier for opponents to read and block [25]. Secondly, the left position (7) gives more chances for a longer ball travel, making the attacks from the left position must travel longer distances before reaching the opponent's side of the volleyball court and giving the opponent more time to react [26]. Thirdly, the left position (7) makes it difficult for the players to synchronize with the setters, making the left-hand volleyball players tend to need more complex passes to be able to perform effective back attacks and increase the risk of mistakes [27]. It can be concluded from the results of this study that the best positions to execute the back attacks are the center and right positions of the volleyball court. In contrast, the left position (7) seems to be the least advantageous position to direct the back attacks due to the technical problems. Although it is important for the volleyball players to put themselves in the correct position to score effective back attacks, training them to execute effective back attacks from various positions is imperative to enhance the overall quality of the volleyball team. Hence, it seems important for the coaches to input the best strategies to perform back attacks from various positions, even the most disadvantageous ones to improve the scores of the volleyball teams during the volleyball matches.

Furthermore, the findings of this study have important implications for the development of volleyball game strategies, especially for the optimization of the back attacks. First, the coaches and the volleyball teams can improve their understanding of the influences of different positions of the back attacks. Hence, the coaches can design more targeted training programs that help their players adapt to various positions they may face during the volleyball matches. In addition, the coaching teams should implement the strategies to allow the volleyball players to execute diverse attack variations during the volleyball matches. For instance, a volleyball team can take advantage of the center position (8) to perform a back attack as their main attack while the players in the right position (9) can optimize their back attacks as the surprise or alternative attacks. In contrast, the players in the left position (7) can attack from different angles or combine their back attacks with other variations of the back attacks to increase the effectiveness of their back attacks. Additionally, understanding the factors that affect the success of a back attack can help coaches improve the quality of passes, their team coordination, and the players' abilities to read their opponents' blocks, improving the team's overall performance during the competition. In conclusion, the results of this study assist in a better understanding of the influences of positions during the execution of the back attacks on a team's performance.

5. Conclusions

Examining back attacks, one of the key attack variations in volleyball matches, can improve coaching tactics and volleyball players' performance during competition, particularly in Indonesian volleyball contexts. Hence, the objective of this study was to examine the effectiveness of back attacks from the left, center, and right positions. This study used a quantitative research design by applying an observation sheet that measured the effectiveness of back attacks during the volleyball matches. In addition, we utilized several criteria to choose the research subjects. As a result, we investigated 24 final matches of four teams competing in the final round of the 2024 Proliga. Besides conducting a pilot test to ensure the validity and the reliability of the research instrument, we performed an inter-rater reliability test. The results of the pilot test and

the inter-reliability suggested a moderately high level of reliability and validity of both research instruments and the observers' scoring ratings. We also asked the permission from the organizers of the 2024 Proliga and the representatives of the volleyball teams involved in this study. The results of this study show that the back attacks executed from the center position 8 have the highest success rate and the most effective back attacks among those performed from other positions. Meanwhile, the back attacks given from the right position (9) scored as the second most effective back attacks. On the other hand, the back attacks performed from the left position of the volleyball court were shown as the least effective back attacks. The findings of this study suggest the importance of providing suitable training programs to the players so that they can perform effective back attacks from any position to ensure the success of their teams.

In spite of the efforts to limit the disadvantages of this study, we were not without some limitations. First, this study only included male athletes from four top volleyball teams in Indonesia. This might lead to certain biases as the sample might not reflect the whole population of the volleyball teams in Indonesia. However, although this study analyzed the male athletes competing in the 2024 Proliga, the findings of this study can provide certain insights to improve the conditions of training programs, particularly in the context of the volleyball teams in Indonesia. Thus, in order to improve the representation issue of this study, the next study should include more diverse samples of participants. For instance, the next study should analyze both male and female volleyball athletes to provide a better reflection of the whole population of the volleyball athletes in Indonesia. Next, this study was conducted in a relatively short period of time due to funding limitations. This relatively short duration of study might impact the depth of analysis of the findings. The subsequent studies should take a longer period to allow more time for researchers to reflect on the results of this study. Besides that, the subsequent studies should involve the analysis of the impacts of various attacks on the overall performance of a team to assist both coaching teams and researchers in a wider analysis of the performances of volleyball athletes.

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