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Kinematic Analysis of the Ushiro Mawashi Geri Kick in Karate Athletes

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Abstract. This study aimed to analyze the kinematic characteristics of the Ushiro Mawashi Geri kick performed by karate athletes using Dartfish motion analysis software. The study employed a qualitative descriptive approach involving five male karate athletes selected through purposive sampling based on specific criteria. Data were collected through observation, video documentation, kicking performance tests, and motion analysis using Dartfish software. The analysis focused on the preparation, execution, and follow-through phases of the kick. The findings showed that the athletes generally demonstrated good performance in executing the Ushiro Mawashi Geri technique. The Dartfish analysis results indicated 3.33% in the excellent category, 73.67% in the good category, 13.00% in the poor category, and 10.00% in the very poor category. Several technical weaknesses were still identified, particularly in body balance, movement coordination, and foot positioning during the rotational and follow-through phases. This study concludes that kinematic analysis using Dartfish software can be utilized as an evaluation tool to improve the effectiveness and efficiency of Ushiro Mawashi Geri techniques in karate training. However, due to the limited number of participants, the findings are exploratory and cannot be generalized broadly.

Keywords: Kinematics; Karate; Ushiro Mawashi Geri; Dartfish

INTRODUCTION

Sports are physical activities designed to achieve optimal performance both individually and collectively through the support of appropriate science and technology. Such achievements are realized through systematic early-age coaching that includes the development of techniques, tactics, strategies, and scientific approaches (Penjas, 2025). In addition to improving athletic achievement, sports also play an important role in developing athletes' physical condition, mental strength, discipline, and character comprehensively (Palaguna et al., 2022). Sports training encompasses physical, technical, and tactical aspects as efforts to enhance performance (Adranata & Adi, 2024) . (Adranata & Adi, 2024) Achieving maximum performance requires well-planned, measurable, and sport-specific training programs supported by continuous effornd hard work (Afrizal et al., 2024). Karate, as a martial art sport, not only contributes to physical and mental well-being but also serves as a competitive sport at regional, national, and international levels (Palaguna et al., 2022). In karate, the categories commonly contested are kata and kumite. Along with the development of karate in Indonesia, this sport has gained increasing popularity among various groups, ranging from school students to university students (Geofani et al., 2026). This development is reflected in the growing participation of athletes in regional and national championships that feature both kata and kumite events for male and female athletes at junior and senior levels. These conditions indicate that karate functions not only as a martial art but also as an achievement-oriented sport that continues to develop competitively.

In modern karate competitions, an athlete's ability to execute effective attacking techniques is an essential factor in gaining points and winning matches (Geri et al., 2026). In performing the Mawashi Geri kick, body balance becomes an important physical component because it determines body stability both in static and dynamic conditions(P et al., 2022). One of the techniques that requires complex movement ability is the Ushiro Mawashi Geri kick, which is a spinning kick that relies on body rotation, flexibility, and target accuracy to produce an effective attack during competition (Physical & Recreation, 2022). This kick combines rotational movement with an attack directed toward the opponent's head or body by utilizing the power generated from body rotation and lower-limb flexibility (Smp & Pemalang, 2025). In line with the findings of (Physical & Recreation, 2022) The Ushiro Mawashi Geri kick is recognized as a technique that

requires complex movement coordination because it involves the displacement of the body's center of gravity. When executed with proper technique, this kick can produce a fast and difficult-to-anticipate attack. However, in practice, many athletes still experience technical errors, such as insufficient balance during rotation, less optimal kicking angles, and inaccurate timing of contact with the target, as stated by (Kusmirantini, 2019). The kick is categorized as a side kick movement in which the kicking leg follows a curved trajectory resembling an arc from the outside toward the inside, targeting the opponent positioned in front or at the side (Di et al., 2017).

These technical errors may affect the effectiveness of the kick and increase the risk of injury for athletes. Therefore, a kinematic analysis of the Ushiro Mawashi Geri kick is important to identify effective movement characteristics that can support the improvement of athletes' performance in kumite competitions. Based on the researcher's observations during several karate competitions held at Gelanggang Remaja Sutomo and GOR Mini Pancing in January 2026, it was found that the Ushiro Mawashi Geri kick was generally performed quite well; however, several technical errors were still identified during its execution. These errors were evident in movement coordination, body balance, and inefficient use of power, causing the kick to consume excessive athlete energy. Observations conducted in several karate dojos also indicated that athletes tended to focus more on mastering the kick itself without paying sufficient attention to proper movement techniques. This habit was carried into competitions, resulting in less optimal kicking effectiveness. In addition, interviews with coaches conducted on January 10, 2026, revealed that athletes tended to prioritize performing the kick quickly rather than understanding the correct technical phases of the movement.

Based on these problems, a kinematic study is needed to analyze the movement of the Ushiro Mawashi Geri kick in order to identify common technical errors and provide evaluation material for improving athletes' performance.

METHOD

This study employed a qualitative descriptive approach to examine the kinematics of the Ushiro Mawashi Geri kick performed by athletes at Karate Dojo Bina Pemuda Medan. This approach was selected because the research focused on an in-depth analysis of athletes' body movements based on the technical characteristics of the kicking motion. The study was conducted at Dojo Bina Pemuda Medan, located on Jalan Sering Sidorejo,

Medan Tembung, in January 2026. The research subjects consisted of male athletes from Dojo Bina Pemuda who were selected using a purposive sampling technique. In line with Sudjana (2008:168), as cited in (Prasetyo et al., 2023)

purposive sampling is defined as a sampling technique conducted based on individual considerations or the researcher's judgment. The sample criteria included senior high school-level athletes who actively participated in training sessions, were capable of performing the Ushiro Mawashi Geri kick technique, and had experience in karate training and competitions. Based on these criteria, the study involved five athletes as research samples. The data analysis technique employed descriptive qualitative analysis supported by tables and percentage calculations. According to (Wulan et al., 2025) this type of research is more oriented toward data, facts, and the observed objects; therefore, the findings are presented in the form of field data and factual evidence rather than theoretical assumptions. The collected data were then classified into assessment categories to describe the quality of the athletes' kicking techniques.

The results of the analysis were used to identify movement errors that frequently occurred and to provide evaluation material for improving the effectiveness of the Ushiro Mawashi Geri kick technique. According to (Spradley & Huberman, 2024). participants in this study were male athletes from Dojo Bina Pemuda Medan who actively participated in karate training activities.

The participants were selected using a purposive sampling technique based on specific criteria determined by the researcher. This qualitative data collection technique positioned the researcher as an active part of the observed social activities, enabling the acquisition of authentic understanding through mental, emotional, and physical involvement (Indah et al., 2025). Based on these criteria, the study involved five athletes as participants. This technique is commonly used because the sample does not need to statistically represent the population, but rather to provide rich and in-depth information (Wulan et al., 2025). The selection of participants aimed to obtain comprehensive data regarding the kinematic characteristics of the Ushiro Mawashi Geri kicking movement. All participants were observed while performing the kicking technique to identify movement patterns, body coordination, balance, and technical accuracy during kick execution.

The materials and equipment used in this study included a karate training field, karate uniforms (gi), and an assessment instrument for the Ushiro Mawashi Geri kick technique. The study also utilized a video camera to record the athletes' movements while performing the kick, allowing the motion analysis process to be conducted in greater detail. According to experts such as Sugiyono, as cited in (Jailani, 2023) qualitative research instruments include the researcher as the key instrument, interviews, questionnaires, recording devices (camera/audio), documents, and writing tools for observation notes. In line with (Prasetyo et al., 2023) qualitative research instruments consist of the researcher as the primary instrument, along with interviews, questionnaires, recordings, documents, and observational field notes.

In addition, this study employed the Dartfish application as a motion analysis tool to observe the stages of the kick, including the preparation phase, execution phase, and follow-through phase (Doewes et al., 2023) This application is capable of analyzing professional sports videos by providing detailed athlete movement breakdowns through frame-by-frame analysis, slow motion, tagging, and angle measurement, making it highly suitable for examining movement techniques. The assessment instrument was developed based on the technical indicators of the Ushiro Mawashi Geri kick, including body position, movement coordination, balance, and movement accuracy during kick execution. In line with (Novetra et al., 2026) video analysis in sports research improves the objectivity of technical assessment while facilitating the detailed identification of movement errors.

The research procedure began with a preliminary observation to identify problems related to the Ushiro Mawashi Geri kick technique among athletes at Karate Dojo Bina Pemuda Medan. After identifying the research problems, the researcher selected participants who met the research criteria using a purposive sampling technique.

The next stage involved the data collection process. Participants were instructed to perform the Ushiro Mawashi Geri kick technique according to the researcher's directions. During this process, the athletes' movements were recorded using a video camera to obtain detailed movement data. The recorded videos were then analyzed using the Dartfish application to examine the kinematic characteristics of the kicking movement. The analysis focused on several movement phases, namely the preparation phase, the execution phase of the kick, and the follow-through phase. Each movement

was analyzed using an assessment instrument developed based on the technical indicators of the Ushiro Mawashi Geri kick. Furthermore, the analysis results were classified into assessment categories to determine the quality of the athletes' movement techniques and to identify movement errors that frequently occurred.

The results of data analysis in qualitative research were used to transform raw data into meaningful findings through the stages of data reduction, data presentation, and conclusion drawing, thereby generating an in-depth understanding of phenomena such as karate techniques.

RESULT AND DISCUSSION

Result

Based on the assessment conducted by karate sports experts, most athletes were categorized as good in performing the Ushiro Mawashi Geri kick technique. This study employed a qualitative descriptive approach to analyze the kinematic characteristics of the Ushiro Mawashi Geri kick technique among athletes at Karate Dojo Bina Pemuda Medan in 2026. The research data were obtained through observation, video documentation, and motion analysis using the Dartfish application. The data analysis technique was carried out qualitatively through the stages of data reduction, data presentation, and conclusion drawing. The motion analysis results were then presented in the form of tables and percentages to facilitate the interpretation of the research findings. The analysis was conducted based on the technical indicators of the Ushiro Mawashi Geri kick, which included the preparation phase, execution phase, and follow-through phase.

Through this analytical process, the researcher was able to identify the level of movement accuracy, body coordination, balance, and technical errors that still occurred when athletes performed the Ushiro Mawashi Geri kick. The expert assessment indicated that the athletes were generally able to perform the basic stages of the movement correctly, particularly in terms of forward gaze, kumite stance, and body rotation during kick execution. However, several deficiencies were still identified in the coordination of leg movements and the accuracy of the final kicking position. Overall, the percentage results of the analysis using the Dartfish application showed 3.33% in the Excellent category, 25.00% in the Good category, 2.00% in the Poor category, and 21.00% in the Very Poor category. Meanwhile, the karate experts' assessment results showed 10.00%

in the Excellent category, 80.00% in the Good category, 3.00% in the Poor category, and 6.00% in the Very Poor category.

The findings of this study indicate that the Ushiro Mawashi Geri kick technique among karate athletes at Dojo Bina Pemuda Medan was generally classified as good. Nevertheless, improvements are still required in several technical aspects, particularly leg movement coordination, body balance, and the final kicking position, in order to make the movement more effective and efficient.

Table and Picture

1. Prefix Position

Figure 1. The Initial Position of the Comparing Athlete

2. leg position to the target

Figure 2. Leg Allowance Position To Target Comparing Athlete

3. Final Movement Position

Figure 3. Final Position of the Comparing Athlete

Based on the image above, the following data can be obtained:

Table 1. National Athlete Movement Position (Comparison)

Name	Position	Right Hand	Left Hand	Right Foot	Left Foot
Comparison athlete	Preparation Phase	76.4^0	131.1^0	152.4^0	161.4^0
	Foot Contact Phase	170.2^0	110.8^0	148.0^0	146.9^0
	Follow-through Phase	76.9^0	125.3^0	142.1^0	146.9^0

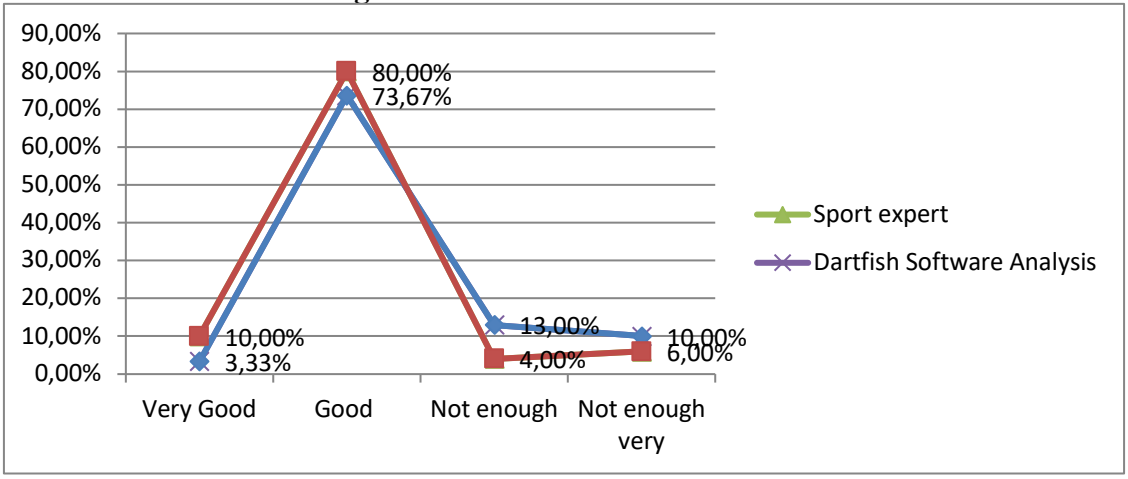
Table 2. National Athlete Movement Position (Comparison)

No	Participant	Prefix Phase	Foot Permonation to Target	Final Movement
1	Athlete 1	Not enough	Good	Good
2	Athlete 2	Not good	Good	Good
3	Athlete 3	Not good	Not enough	Good
4	Athlete 4	Not good	Not enough	Good
5	Athlete 5	Not enough	Good	Good

Table 3. Overall Percentage of Success rate of Ushiro Mawashi Geri Kicks

Category	Dartfish Analysis	Karate Expert Assessment
Very well	3,33%	10,00%
Good	73,67%	80,00%
Not enough	13,00%	4,00%
Very Less	10,00%	6,00%

Table 4. Overall Percentage of Athletes' Success Rate



Discussion

The results of the study indicate that the Ushiro Mawashi Geri kick technique performed by athletes at Karate Dojo Bina Pemuda Medan was generally categorized as good based on the assessment of karate sports experts. However, the analysis conducted using the Dartfish application still revealed several technical errors in the preparation phase, foot contact phase with the target, and follow-through phase. In the preparation phase, the most frequently identified errors included hand positioning, foot angle, and body balance during the execution of the stance.

In the foot contact phase, several athletes were not yet able to perform movement coordination and body rotation optimally, resulting in less efficient kicking performance. Meanwhile, in the follow-through phase, most athletes were able to return to the kumite position properly, although some deficiencies in maintaining body balance were still observed. The differences between the Dartfish analysis results and the expert assessments indicate that video-based kinematic analysis is capable of providing a more detailed and objective description of movement performance. The findings of this study are consistent with previous biomechanical research in karate, which emphasizes the importance of hip rotation, body coordination, and dynamic balance in executing spinning kick techniques effectively (Gavagan & Sayers, 2017). According to (Udara & Chandana, n.d.), Ushiro Mawashi Geri requires strong lower limb power and coordinated rotational movement to produce optimal kicking force and accuracy. Similarly, (Jung & Park, 2022) stated that spinning kick techniques involve complex movement patterns that require athletes to maintain body stability while generating rotational momentum.

The results of the present study showed that several athletes still experienced difficulties in maintaining balance during the rotational phase and follow-through movement. This finding supports the study conducted by (Smp & Pemalang, 2025), which reported that dynamic balance significantly influences the effectiveness of Mawashi and Ushiro Mawashi Geri kicks. In addition, the use of Dartfish software in this study provided more objective and detailed movement analysis, supporting previous findings by (Novetra et al., 2026), who explained that video-based motion analysis improves the accuracy of technical evaluation in martial arts performance.

Therefore, the use of kinematic analysis can assist coaches and athletes in evaluating and improving the Ushiro Mawashi Geri kick technique in order to achieve greater effectiveness and efficiency in karate competitions.

CONCLUSION

Based on the results and discussion of this study, it can be concluded that the kinematic analysis of the Ushiro Mawashi Geri kick technique using Dartfish software demonstrated that the athletes' overall movement accuracy was categorized as good. These findings indicate that the athletes were generally able to perform the sequence of kicking movements in accordance with the correct technical stages. In addition, the validation and assessment conducted by karate sports experts further confirmed that the execution of the Ushiro Mawashi Geri kick technique by athletes at Dojo Bina Pemuda Medan met the criteria of a good level of movement performance.

Nevertheless, this study also identified several deficiencies among some athletes, particularly during the body rotation phase while executing the spinning kick and in maintaining body stability during kick performance. This study was limited by the small number of participants involved; therefore, the findings cannot be generalized to all karate athletes. Future studies are recommended to involve larger samples and quantitative biomechanical measurements to obtain more comprehensive findings regarding the Ushiro Mawashi Geri kick technique. These conditions suggest that the athletes' movement coordination, balance, and body control still require improvement in order for the Ushiro Mawashi Geri kick technique to be executed more effectively, efficiently, and in accordance with the biomechanical principles of karate movements.

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