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Biomechanical Analysis of Archery Technique Movements based on Android Studio

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ABSTRACT: The purpose of the study was to determine how good the basic release archery technique was for male archery club athletes with a quantitative descriptive design using descriptive methods. The study population was 28 Selabora archery club athletes. The sample was taken using purposive sampling totaling 14 athletes, with the criteria of male adolescent athletes and not in a state of illness. The instrument used was a release assessment rubric which was analyzed using descriptive percentages with an Android Studio-based tool. The results of the open smash study for male athletes were in the very poor category of 0.00% (0 athletes), poor 71.43% (5 athletes), good 28.57% (2 athletes), and very good 0.00% (0 athletes). Based on the average value of the basic open smash technique for male athletes of the Selabora archery club in the poor category.

KEYWORDS: Archery techniques release, android studio, biomechanics, archery

I. INTRODUCTION

Archery, seen from a biomechanical perspective, is classified as a skill, namely throwing an object to achieve maximum accuracy (Prasetyo, 2018). Skill in archery is defined as the ability to shoot an arrow at a given target within a certain time frame with accuracy (Prasetyo, 2016). In the 70-meter recurve event, this is the longest distance for both men and women. An arrow will travel on a parabolic trajectory (Callaway et al., 2017). This is influenced by several forces acting on the arrow (Prasetyo et al., 2022). To anticipate these issues, an athlete must understand the techniques required to ensure the arrow stays on target. Archery, it seems, is not an easy sport for untrained athletes; even trained athletes often encounter difficulties.

Thus, the things that need to be done are: Analyzing the speed of arrow movement and arrow accuracy, then the results of the analysis are used appropriately as a contribution to developing achievements, especially movement efficiency; Knowing the factors that inhibit the efficiency of archery technique movements (Zulkifli et al., 2013). Biomechanics is a branch of sports science that studies the movements of the body or athletes (Enriquez & Cesar, 2021; Humaid et al., 2021; Peng et al., 2021; Wibowo et al., 2022). Biomechanical sports performance analysis is a method with the aim of determining the performance of certain sports techniques, namely, to increase understanding of the mechanisms that influence performance, characterize athletes, and provide insight into injuries (Alberola-Zorrilla et al., 2024; Ji et al., 2024; Suhasto et al., 2023; Vasilis et al., 2024; Yachsie et al., 2024).

Based on observations at the Selabora archery club, several issues still arise when players perform the release. Archers do not perfect the release technique, causing the arrow to miss the target and tend to spin. This impacts athletes' lack of confidence in their technique during competitions, resulting in some athletes being deemed inefficient when performing unstable releases. Another gap is that coaches still generalize existing techniques. In fact, each sport's technique has its own characteristics, and coaches should understand the characteristics of each athlete. Some coaches still provide general, non-specific equipment usage so that frequently used facilities must be in accordance with the technique and its use must be correct and appropriate. There are still coaches who train their trainees on technical movements that are not properly implemented. From the opinions above, it can be concluded that to achieve optimal performance in archery, an understanding of the mechanisms that influence performance, athlete characterization, and providing insight into injuries that can be obtained from analysis using biomechanical studies is necessary.

Android Studio is the official Integrated Development Environment (IDE) for Android application development, based on IntelliJ IDEA (Mardyanto, 2019). In addition to being a powerful code editor and IntelliJ developer tool, Android Studio offers many features that increase your productivity in creating Android applications (Sulaksono, 2021). An SDK is a set of tools and software programs used by developers to create applications for a specific platform. Before installing the Android Studio SDK, make sure your device is connected to the internet (Nurseto & Saryono, 2020). Because there will be a download process for the Android Studio SDK components.

Android Studio-Based Archery Motion Analysis Tool. Valid and reliable. The Android Studio-Based Archery Motion Analysis Tool on the language indicator is 85.71% in the feasible category, the training procedure indicator is 82.14% in the feasible

category, the draft indicator of the safe bow mechanical analysis tool is 89.29% in the feasible category, and the draft model indicator of the Android Studio-Based Archery Motion Analysis Tool is easy to implement at 85.71% in the feasible category.

METHOD

This research is a quantitative descriptive study using descriptive methods to answer and solve problems encountered during the research. This instrument uses a questionnaire, namely a rubric or observation sheet by observing the object being studied. Research data was collected by conducting observations through Android Studio, which were documented during the release archery technique. The player released six arrows baited by the researcher. The following are the scoring indicators for assessing the release archery technique.

Table 1. Archery Technique Assessment Rubric Release

Variables	Aspect	Indicator
Relese Archery Technique	Prefix	The process of clamping the arrow on the finger when preparing to release the arrow.
	Grip	Grip When shooting an arrow and the position of the ring finger touching the bow string.
	Release	Release the arrow with the fingers of the arrow hook along the chin.
	Advanced movement	Movement When the elbow joint moves along the chin which is assisted by the scapula bone.
Amount		22

This questionnaire was adopted from research (Lease, Then Sien Phang, et al., 2024) then the validity test uses the product moment correlation formula & Cronbach's alpha reliability test of 0.786, which means the questionnaire is valid and reliable. The population in this study is the Selabora archery club athletes totaling 28 archers. The sample in this study was carried out by purposive sampling with sample criteria, namely: (1) male adolescent athletes, (2) trained in archery, (3) not in a state of illness. Based on this, 7 athletes fulfilled the requirements, with details of 7 male athletes aged 13 and 11 years. The data collection process was carried out using observation and filling in the assessment rubric by three Selabora archery club coaches. then after the data was collected, it was analyzed using descriptive percentages.

RESULTS

Table 2. Frequency Distribution of Men's Relese Archery Techniques

No	Interval	Category	Frequency	Percentage
1	85%-100%	Very good	0	0.00%
2	65%-84%	Good	2	28.57%
3	45%-64%	Not enough	5	71.43%
4	25%-44%	Very less	0	0.00%
Amount			7	100%

Based on the table, it shows that the basic Relese technique in male archery athletes in Selabora is in the category of "very poor" at 0.00% (0 athletes), "poor" at 71.43% (5 athletes), "good" at 28.57% (2 athletes), and "very good" at 0.00% (0 athletes). Based on the average value of the basic open smash technique in male archery athletes in Selabora in the poor category.

Table 3. Frequency Distribution of Initial Stage

No	Interval	Category	Frequency	Percentage
1	85%-100%	Very good	0	0.00%
2	65%-84%	Good	1	14.29%
3	45%-64%	Not enough	6	85.71%
4	25%-44%	Very less	0	0.00%
Amount			7	100%

Based on the table, it shows that the basic release technique in Selabora archery athletes based on the initial stage is in the category of "very poor" at 0.00% (0 athletes), "poor" at 85.71% (6 athletes), "good" at 14.29% (1 athlete), and "very good" at 0.00% (0 athletes). Based on the average value of the basic release technique in Selabora archery athletes based on the initial stage in the poor category.

Table 4. Frequency Distribution of Stages During Grip

No	Interval	Category	Frequency	Percentage
1	85%-100%	Very good	0	0.00%
2	65%-84%	Good	2	28.57%
3	45%-64%	Not enough	5	71.43%
4	25%-44%	Very less	0	0.00%
Amount			7	100%

Based on the table shows that the basic release technique in Selabora archery athletes based on the grip stage is in the category of "very poor" at 0.00% (0 athletes), "poor" at 71.43% (5 athletes), "good" at 28.57% (2 athletes), and "very good" at 0.00% (0 athletes). Based on the average value of the basic release technique in Selabora archery athletes based on the grip stage in the poor category.

Table 5. Frequency Distribution of Release Stages

No	Interval	Category	Frequency	Percentage
1	85%-100%	Very good	0	0.00%
2	65%-84%	Good	1	14.29%
3	45%-64%	Not enough	6	85.71%
4	25%-44%	Very less	0	0.00%
Amount			7	100%

Based on the table shows that the basic release technique in Selabora archery athletes based on the stage when the release is in the category of "very poor" at 0.00% (0 athletes), "poor" at 85.71% (6 athletes), "good" at 14.29% (1 athlete), and "very good" at 0.00% (0 athletes). Based on the average value of the basic release technique in Selabora archery athletes based on the stage when the release is in the poor category.

Table 6. Frequency Distribution of Advanced Motion Stages

No	Interval	Category	Frequency	Percentage
1	85%-100%	Very good	0	0.00%
2	65%-84%	Good	2	28.57%
3	45%-64%	Not enough	5	71.43%
4	25%-44%	Very less	0	0.00%
Amount			7	100%

Based on the table shows that the basic release technique in Selabora archery athletes based on the advanced movement stage is in the category of "very poor" at 0.00% (0 athletes), "poor" at 71.43% (5 athletes), "good" at 28.57% (2 athletes), and "very good" at 0.00% (0 athletes). Based on the average value of the basic release technique in Selabora archery athletes based on the advanced movement stage in the poor category.

IV. DISCUSSION

This study aims to determine the basic release technique in Selabora archery athletes based on the initial stages, grip, release, and follow-up movements. In this study, the results obtained were still several fundamental errors in the release technique, in accordance with the results of the reality that occurred in the Selabora archery club. This means that several obstacles still arise when archers do release. The results have an impact during training/competitions, these players do not get a correct automation of the release movement sequence which should be fixed because this has an impact during competitions and will continue until they become elite athletes.

Biomechanics studies the forces, movements, and body mechanisms involved in archery (Dorshorst et al., 2022). Some important aspects that are analyzed include body position, bow angle, and drawing technique (Chen et al., 2024). For example, a stable standing position with your feet wide apart can improve balance and strength when drawing the bow (Tinazci, 2011). The correct bow angle also affects the aerodynamics of the arrow, which can increase the distance and accuracy of the shot (Piqué et al., 2015; Vynogradskyi, 2020). Archery is an activity that requires high skill and precision. With the help of biomechanics, movement analysis in archery can be performed to deeply understand how the body interacts with the bow and arrow. Biomechanics studies the forces, movements, and mechanisms of the body, enabling archers to improve efficiency and accuracy with each shot (Lease, Then Sien Phang, et al., 2024). In biomechanical analysis, several important factors are considered, such as body position, arc angle, and applied tensile force (Dorshorst et al., 2022). This means that by measuring the bow angle and draw force, coaches can provide specific feedback to archers, helping them improve their technique and reduce the risk of injury (Ahmad et al., 2013).

This analysis includes a study of the muscles involved in the archery process, which makes the back, shoulder and arm muscles play an important role in drawing the bow effectively (Aslan & Yoncalık, 2023; Lease, Lim, et al., 2024). By understanding how force and tension are applied to these muscles, coaches can design more effective training programs to increase an archer's strength and endurance (Azhar et al., nd; Suhasto et al., 2023; Yachsie et al., 2023). Proper muscle strengthening can help reduce the risk of injury and increase endurance during training sessions or competitions.

V. CONCLUSIONS

Overall, biomechanical analysis of archery technique provides invaluable insights into improving archer performance. By understanding the mechanics of movement and the factors that influence accuracy, coaches can provide more effective instruction. Furthermore, archers can experience improvements in their skills and confidence, ultimately contributing to better results in competitions. Integrating biomechanics into archery training is a crucial step toward developing more qualified athletes. Therefore, biomechanical analysis can be used to evaluate archers' performance in competitive situations. By utilizing technologies such as motion sensors and video analysis, coaches can identify inefficient movement patterns and provide recommendations for improvement. This not only improves shooting accuracy but also helps archers understand the relationship between physical strength, technique, and shot outcomes. With technological advancements, biomechanical analysis in archery is now possible using motion sensors, video analysis, and specialized software. Sensors can record data on speed, angle, and force applied during the shooting process. Video analysis allows coaches and archers to view their movements in real time, making it easier to identify inefficient movement patterns. This data is important to provide specific feedback and help the archer make necessary improvements.

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