Type of Paper (Article, Review, Communication, etc)

Analysis of Carreau Shooting Distances of 6 & 7 Meters Obstacles 1 Petanque Sports Using a Biomechanics Approach

Ahmad Teguh Ramadhan*, Said Junaidi, Hadi, Fajar Awang Irawan, Syahru Romadhoni, Muhammad Muhibbi

Sports Education, Sekolah Pascasarjana, Universitas Negeri Semarang, Indonesia

*Corresponding Author: teguhramadhan741@gmail.com

Abstract. The importance of movement analysis that results in shooting carreau petanque a distance of 6 and 7 meters, shooting carreau is the result with the best value in the sport of petanque. This study aims to improve shooting results by analyzing the initial internal factors that affect movement. The approach and method use a descriptive approach with survey methods and quantitative data analysis using the Kinovea application software version 0.9.4. The results showed that the average SD ± shoulder joint angle, elbow joint angle, wrist joint angle, waist angle, and knee joint angle at 1) the backswing phase produced a speed of 0.85 m/s - 0.36 m/s ± 0.42 m/s - 0.19 m/s. 2) the swing phase produced a speed of 3.26 m/s – 2.81 m/s ± 0.67 m/s - 0.25 m/s. 3) the release phase produced a speed of 8.89 m/s - 8.41 m/s ± 0.75 m/s - 0.46 m/s. The conclusion is that shooting carreau at a distance of 6 and 7 meters in obstacle 1 obtained an average of the medium category with a percentage of 56.67% / 46.67%. This research suggests that it can be used as a reference for coaches in making training programs for each athlete.

Key words: analysis, biomechanics, kinovea, petanque, shooting.

Abstract in Indonesia. Pentingnya analisis gerakan yang menghasilkan shooting carreau petanque jarak 6 dan 7 meter, shooting carreau merupakan hasil dengan nilai terbaik dalam cabang olahraga petanque. Penelitian ini bertujuan untuk meningkatkan hasil perolehan shooting dengan menganalisis faktor intern awal yang mempengaruhi gerakan. Pendekatan dan metode menggunakan pendekatan deskriptif dengan metode survey dan analisis data kuantitatif menggunakan softwere aplikasi kinovea versi 0.9.4. hasil penelitian menunjukkan rata-rata ± SD sudut shoulder joint, sudut elbow joint, sudut wrist joint, sudut pinggang, sudut knee joint pada 1) fase backswing menghasilkan kecepatan 0,85 m/s – 0,36 m/s ± 0,42 m/s – 0,19 m/s. 2) fase swing menghasilkan kecepatan 3,26 m/s – 2,81 m/s ± 0,67 m/s – 0,25 m/s. 3) fase release menghasilkan kecepatan 8,89 m/s – 8,41 m/s ± 0,75 m/s – 0,46 m/s. Simpulannya yaitu shooting carreau pada jarak 6 meter obstacle 1 memperoleh rata-rata kategori sedang dengan persentase 56,67% / 46,67%. Saran penelitian ini yaitu dapat digunakan untuk referensi pelatih dalam membuat program latihan pada setiap atletnya.

Kata Kunci: analisis, biomekanika, kinovea, petanque, shooting.

INTRODUCTION

Sports play an important role in making the name of an institution, institution, and country proud (Pratiwi et al., 2018) (Wisnu, 2022). Sports have developed so rapidly and not only as a physical activity but also as a means to develop various other aspects and contain many positive values such as important pillars because the spirit of fair play, sportsmanship, teamwork, and nationalism can be formed and built through sports (Rahman, 2018) (Alimuddin et al., 2021) (Terok & Huwae, 2021). Aspects that can be developed through sports include cognitive, social, and emotional aspects. These aspects apply to any sport, one of which is petanque.

Petanque is a new sport in Indonesia, petanque is a sport that relies on several aspects such as concentration, accuracy, and accuracy which in it is very influential in the emotional aspect. This sport can be played by various ages and this sport is relatively cheap because this sport can be played anywhere and anytime as long as the terrain used is solid or hard (Bustomi et al., 2020) (Irawan, Ghassani, et al., 2022). Petanque is a game from France, which is played by rolling balls made of iron

as close as possible to balls made of wood or can be called pointing techniques. Pointing also has several ways to do it such as roll, soft lob, and full lob, besides that there is also a throw that drives the opponent's ball away from the target box or can be called a shooting technique. Shooting There are several ways to do it such as a shot on the iron, a short shot, and a ground shot (Okilanda, et al., 2018:69-76) (Sabilla et al., 2021).

Petanque sports compete in 11 numbers, namely single men (one son), single women (one woman), double men (two men), double women (two women), double mix (one son and one daughter), triple men (three men), triple women (three women), this triple mix is divided into two triple mixes with (two girls one son) and (two boys and one daughter), And there is a special number in the sport of Petanque, namely the shooting number played by shooter men, shooter women called shooting men and shooting women by shooting 5 disciplines with a distance of 6 meters, 7 meters, 8 meters, and 9 meters, with one chance to shoot discipline 1 discipline 5 (Pelana, 2016:117-122).

In throwing shooting several factors affect the result of the throw, including movement or mechanics, the height of the ball bounce, and the angle or point of the ball falling against the target. By the opinion of Souef, (2015) (Rusdiana et al., 2019) (Hammed et al., 2023) the movement or biomechanics of the game of petanque greatly affect the outcome of the shooting throw. Biomechanics in petanque games can also minimize the risk of injury that occurs, minimize the risk of injury, the need for analysis related to shooting petanque and provide evaluation in improving movement when there are problems or obstacles (Irawan & Paulina, 2022) (Dyky & Kusuma, 2021). Appropriate in research Sinaga, & Ibrahim, (2019) mentioned that four main indicators determine the shooting throw: backswing, swing, release, and ball height. The four indicators are interrelated and influence each other. There are three types of shooting throws or shots namely carreau, reussi, touche, and manque according to the study by Ardhiyanto, (2021). Phases/segments and indicators in the shooting throw to produce consistent accuracy or precision. A shooting throw is said to be consistent if the result of the throw has the same angle and point or does not change.

A special shooting number where players compete to collect as many points as possible by official regulations from FIPJP, in this number there is a maximum of 100 points, while athletes owned by UKM Petanque UNNES have not been able to get maximum points. Several factors cause UNNES Petanque athletes to be unable to get maximum points, one of which is the inconsistency of shooting throws that are influenced by mechanics or motion. Therefore, it is necessary to analyze the mechanics or movements to obtain maximum consistency of throwing results and points when competing (Pasaribu et al., 2021).

Why is it necessary to study sports biomechanics? For a physical education teacher, trainer, or some other physical activity specificer sports biomechanics is needed (Faoziyah & Suharjana, 2020) (Wijaya et al., 2021). Starting from identifying talents, training techniques, evaluating techniques, and providing therapeutic exercises (movement technique formation exercises), to determining the equipment that will be used by athletes (Emery & Tyreman, 2009) (Ma'dum & Irawan, 2021). Biomechanics is a field of science that studies motion which is used to study a movement that can later be used as a reference for motion techniques in sports (Santoso & Setiabudi, 2019). In addition, having a good knowledge of biomechanics will allow you to evaluate techniques used in unknown sports skills, as well as to better evaluate new techniques in known sports (Maffulli et al., 2011).

Based on observations obtained by researchers from the 2022 Provincial Student Sports Week (POMPROV) match at the petanque field of Semarang State University (UNNES), it can be concluded that there have been no consistent shooting results at a distance of 6 and 7 meters at obstacle 1. This study focused on a distance of 6 and 7 meters. A distance of 6 meters because in throwing shooting must go through a consecutive distance and at a distance of 6 meters is the beginning of the distance where the player shoots and the beginning of the distance that determines the outcome of the next distance. A distance of 7 meters because in throwing shooting must go through a consecutive distance and a distance of 7 meters will be decisive if the same score is obtained. From the problems found by the researchers, the researchers are interested in holding an analysis related to the consistency of the results of shooting throws or shots in petanque sports in which there are several factors, namely biomechanics, ball bounce height, and angle or drop point against the ball target (Friskawati & Supriadi, 2022) (Irawan et al., 2019). In conducting the analysis, researchers used the help of the Kinovea software application version 0.9.4 because Kinovea Software version 0.9.4 is a video analysis tool for exercise in one of the sports by slowing down a movement to be analyzed and recorded (Surahman, 2020). The advantages of Kinovea

software version 0.9.4 make it easier to analyze movements through exercise videos by slowing down the movements to be documented and as evaluation material (Jariono, et al., 2020) (Irawan et al., 2021).

METHODS

Judging from its purpose, this research uses a pure type of research with survey methods. Judging from the level of explanation, this study uses descriptive research to describe or describe the data that has been collected as it is and systematically, seen from the analysis and type of data this research uses quantitative methods because the research data is in the form of numbers and analyzed using statistics (Rezki, 2016) (Ma'dum & Irawan, 2021) (Wahyunal & Gazali, 2021). This study was intended to analyze the muscle force of hand thrust and movement speed from three indicators, namely; backswing movement phase/segment, swing movement phase/segment, and release movement phase/segment. The three phases of movement focused on a distance of 6- and 7-meters obstacle 1 with the help of analysis using the Kinovea application software version 0.9.4.

The population in this study is a member of the UNNES petanque Student Activity Unit. This study used purposive sampling techniques. The sampling criteria are; active students who are members of UKM Petanque UNNES, have participated in matches, especially in shooting game numbers. The number of samples in this study based on these characteristics amounted to 9 people, consisting of 5 men and 4 women.

The data collection techniques used are observation, observing when UNNES petanque UKM athletes carry out training and participate in championships, especially in shooting numbers where the acquisition of values is influenced by a series of movements when throwing; documentation, collecting and investigating the results of previous matches where the results are used as supporting data in this study and documentation of movements when carrying out shooting throws by recording or taking pictures of athletes as samples using digital cameras; test, Precision Shooting Test This test aims to determine the acquisition of value when shooting a game. This study used data capture instruments with digital cameras and precision shooting tests.

Table 1. Precision Shooting Norms

Category	Score
Very Low	$X \leq 8$
Low	$8 < X \leq 13$
Keep	$13 < X \leq 18$
Tall	$18 < X \leq 23$
Very high	$23 < X$

(Source: Research 2023)

Processing percentage data is obtained using the formula from Azahrah et al., (2021) that is:
NP = (n/N) x 100%
Information:
NP: Value in %
n: Earned value
N: Total data

RESULTS AND DISCUSSION

The results of research on the analysis of backswing, swing, and release distance of 6 and 7 meters obstacle 1 are to determine the angle of the shoulder joint, angle of the elbow joint, angle of the wrist joint, angle of the waist, angle of the knee joint, distance, height of the ball, time, and speed when making movements. Data from the backswing analysis of 6-meter obstacle 1 can be seen in Table 2. Data from the analysis of the swing distance of 6 meters obstacle 1 can be seen in Table 3. Data from the analysis of the release distance of 6 meters in obstacle 1 can be seen in Table 4. Data from the backswing analysis of 7-meter obstacle 1 can be seen in Table 5. Data from the analysis of the swing distance of 7 meters obstacle 1 can be seen in Table 6. Data from the analysis of the release distance of 7 meters in obstacle

1 can be seen in Table 7.

Table 2. Analysis of Backswing Shooting Carreau of Distances 6 Meters Obstacle 1

N=9	Min	Max	Mean	± SD
Angle Shoulder Joint (^{0})	20.8	100.3	65.1	27.0
Angle Elbow Joint (^{0})	156.2	180.0	173.3	7.2
Angle Wrist Joint (^{0})	107.3	177.3	139.4	18.5
Angle Waist Joint (^{0})	110.9	156.1	136.2	11.3
Angle Knee Joint (^{0})	150.4	178.3	166.6	8.1
Time (s)	1.17	4.10	2.64	1.07
Speed (m/s)	0.44	1.72	0.85	0.42
Distance(cm)	123.38	240.62	185.67	0.36
Height of the Ball (cm)	82.94	162.56	131.95	21.23

(Source: Research 2023)

Table 3. Analysis of Swing Shooting Carreau of Distances 6 Meters Obstacle 1

N=9	Min	Max	Mean	± SD
Angle Shoulder Joint (^{0})	64.4	93.1	76.5	7.8
Angle Elbow Joint (^{0})	151.5	179.9	173.6	8.1
Angle Wrist Joint (^{0})	138.5	178.8	164.9	15.2
Angle Waist Joint (^{0})	120.9	175.9	147.5	16.7
Angle Knee Joint (^{0})	132.2	172.8	154.0	12.0
Time (s)	0.33	0.50	0.42	0.05
Speed (m/s)	2.41	4.35	3.26	0.67
Distance(cm)	118.94	171.74	135.18	0.16
Height of the Ball (cm)	53.85	81.93	66.45	8.24

(Source: Research 2023)

Table 4. Analysis of Release Shooting Carreau of Distances 6 Meters Obstacle 1

N=9	Min	Max	Mean	± SD
Angle Shoulder Joint (^{0})	75.3	114.3	94.1	9.8
Angle Elbow Joint (^{0})	144.7	179.8	171.5	11.0
Angle Wrist Joint (^{0})	99.2	179.4	148.4	25.0
Angle Waist Joint (^{0})	123.0	172.3	148.1	14.9
Angle Knee Joint (^{0})	135.9	174.2	156.0	10.8
Time (s)	0.03	0.03	0.03	0.00
Speed (m/s)	7.24	9.86	8.89	0.75
Distance(cm)	21.71	29.59	26.66	0.02
Height of the Ball (cm)	64.50	94.74	80.08	10.29

(Source: Research 2023)

A total of 9 samples obtained results from the shoulder joint angle, elbow joint angle, wrist joint angle, waist angle, knee joint angle, ball height, distance from the backswing phase to the release phase, different times and speeds to a distance of 6 meters. It can be seen from the highest sample acquisition for men, namely with a value of 21 included in the high category in the name of Abriyano Nabil Kusuma, and for women, with a value of 22 included in the high category in the name of Septiana Azizatun Nafa.
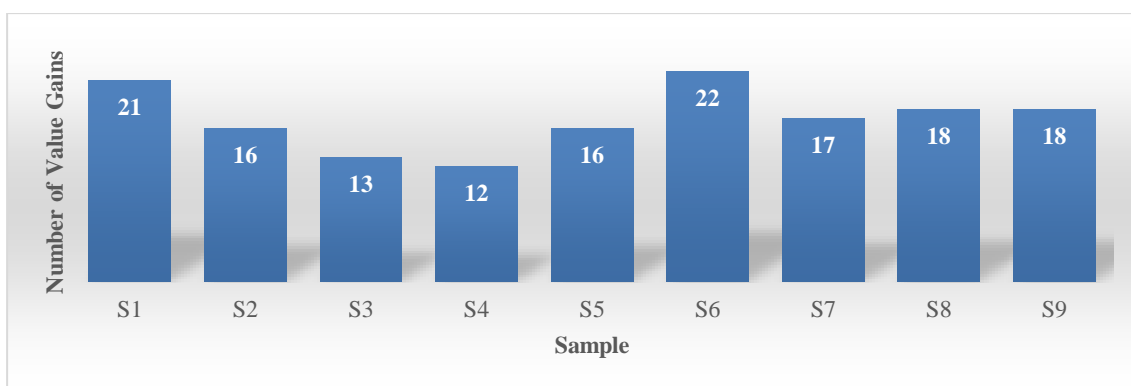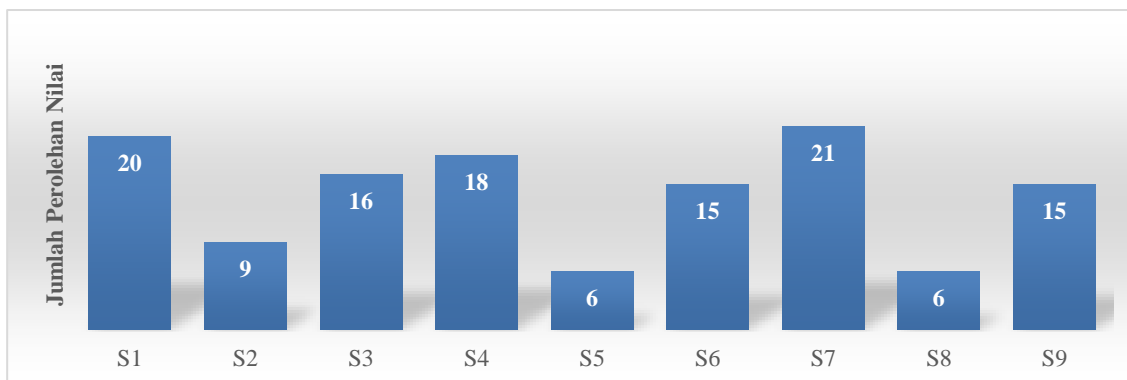
Figure 1. Results of Obtaining a Shooting Value of Distances 6 Meters

Table 5. Analysis of Backswing Shooting Carreau of Distances 7 Meters Obstacle 1

N=9	Min	Max	Mean	± SD
Angle Shoulder Joint (^{0})	31.9	109.4	73.6	24.4
Angle Elbow Joint (^{0})	165.9	179.4	174.1	4.4
Angle Wrist Joint (^{0})	107.7	177.7	134.1	20.2
Angle Waist Joint (^{0})	105.5	154.9	135.4	13.7
Angle Knee Joint (^{0})	145.5	176.8	167.1	9.1
Time (s)	1.44	5.64	3.07	1.22
Speed (m/s)	0.12	0.72	0.36	0.19
Distance(cm)	45.70	125.62	91.29	25.33
Height of the Ball (cm)	87.76	159.27	133.12	20.55

(Source: Research 2023)

Table 6. Analysis of Swing Shooting Carreau of Distances 7 Meters Obstacle 1

N=9	Min	Max	Mean	± SD
Angle Shoulder Joint (^{0})	64.2	86.7	79.0	6.8
Angle Elbow Joint (^{0})	162.9	179.5	175.3	4.8
Angle Wrist Joint (^{0})	138.9	177.2	163.2	11.2
Angle Waist Joint (^{0})	133.1	176.5	153.1	14.0
Angle Knee Joint (^{0})	145.5	174.8	159.4	10.5
Time (s)	0.34	0.47	0.42	0.04
Speed (m/s)	2.39	3.23	2.81	0.25
Distance(cm)	95.64	135.60	118.36	10.95
Height of the Ball (cm)	58.93	82.52	70.69	8.50

(Source: Research 2023)

Table 7. Analysis of Release Shooting Carreau of Distances 7 Meters Obstacle 1

N=9	Min	Max	Mean	± SD
Angle Shoulder Joint (^{0})	81.8	117.0	100.4	10.0
Angle Elbow Joint (^{0})	155.3	179.0	173.6	7.0
Angle Wrist Joint (^{0})	114.7	166.0	153.2	14.5
Angle Waist Joint (^{0})	136.9	174.6	152.9	12.6
Angle Knee Joint (^{0})	145.2	177.5	159.5	11.3
Time (s)	0.03	0.03	0.03	0.00
Speed (m/s)	7.49	9.09	8.41	0.46
Distance(cm)	22.47	27.26	25.24	1.38
Height of the Ball (cm)	70.46	100.49	84.95	11.08

(Source: Research 2023)

A total of 9 samples obtained results from the shoulder joint angle, elbow joint angle, wrist joint angle, waist angle, knee joint angle, ball height, distance from the backswing phase to the release phase, different times, and speeds against a distance of 7 meters. The difference in the results of each segment of motion results in different muscle/touch hand forces and maximum height of the ball. It can be seen from the highest sample acquisition for men, namely with a value of 20 included in the high category in the name of Abriyano Nabil Kusuma, and for women, with a value of 21 included in the high category in the name of Fadhzilatul Al Azmi.

Figure 2. Results of Obtaining a Shooting Value of Distances 7 Meters

The petanque sport special shooting number on obstacle 1 has 4 acquisition values, namely manque or value 0, touche or value 1, reussi or value 3, and carreau or value 5. The results of the above study from 9 samples of UNNES petanque UKM athletes with an average sample height of 164.33 cm, average body weight of 67.44 kg, average body mass index of 20.97 kg / m2 with the underweight category, average length of the shock of 69.99 cm, average arm length 73.83 cm, average leg length 97.52 cm, and average time entering the circle 7.40 s. The discussion of the 6-meter distance study was carried out with six repetitions on each sample, if calculated from the accumulation of throws there were a total of 54 throws. 19 throws explained carreau shots, 18 throws that explained reussi shots, 4 throws that explained touche shots, and 13 throws that explained manque shots. It can be seen from the highest sample acquisition for men, namely with a value of 21 included in the high category in the name of Abriyano Nabil Kusuma, and for women, with a value of 22 included in the high category in the name of Septiana Azizatun Nafa. A distance of 6 meters is the initial distance of throwing a shot that will affect or determine the throw of the shot at the next distance. In theory accuracy, the closer the target will be, the higher the level of accuracy (Irawan & Ghassani, 2022). To produce a high level of accuracy also requires routine training or repetitive movement training, therefore a distance of 6 meters in this sport must produce high values. At a distance of 6 meters will also be greater to have a level of anxiety when making shots (Irawan, Ma'dum, et al., 2022).

The discussion of the 7-meter distance study was carried out with six repetitions on each sample, if calculated from the accumulated throws there were a total of 54 throws. 9 throws explained Carreau shots, 27 throws explained reussi shots, 2 throws explained touche shots, and 16 throws explained manque shots. It can be seen from the highest sample acquisition for men, namely with a value of 20 included in the high category in the name of Abriyano Nabil Kusuma, and for women, with a value of 21 included in the high category in the name of Fadhzilatul Al Azmi. The distance of 7 meters in this sport is a further distance after a distance of 6 meters or you could say the second distance. Each subsequent distance has a distance difference of one meter. A distance of 7 meters is the decisive distance if someone gets the same score if accumulated. This distance is no less important than the previous distance, this distance also determines the result of the throw at the next distance. Inaccuracy theory, this distance has a lower level of accuracy than the previous distance (Irawan & Prastiwi, 2022). However, many athletes are fond of this distance and also score more on average than the previous distance (Irawan & Munir, 2022). Most likely the cause is that when the exercise puts more emphasis on this distance and also the anxiety is lower at this distance. It would be better if all distances could be mastered by athletes in this sport to get maximum scores and high achievements. In throwing shots in petanque, there are three phases of movement, namely the backswing movement phase, the swing movement phase, and the release movement phase. Carreau's shot at a distance of 6 meters resulted in

an average angle of the shoulder joint, elbow joint, wrist joint, waist joint, knee joint, time, speed, distance, and height of the ball that was lower than Carreau's shot at a distance of 7 meters in petanque. The phases of each carreau shooting movement can be seen in figure 3 below.
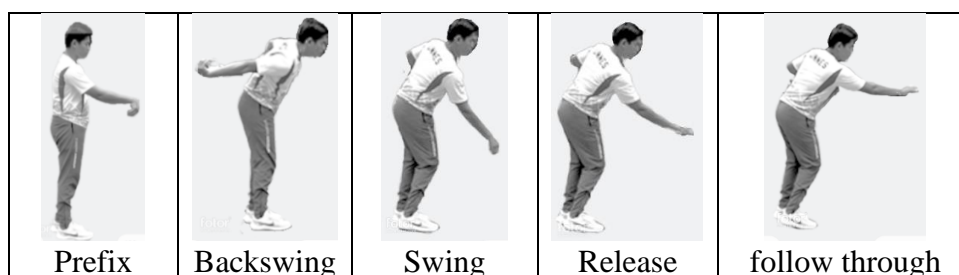

| Prefix | Backswing | Swing | Release | follow through |

Figure 3. Phase Shooting Movement Carreau

The backswing phase movement in petanque shooting is the movement of swinging the hand backward from the starting position. The backswing phase is obtained when the hand stops swinging backward. To get a carreau shot at a distance of 6 and 7 meters in petanque sports in the backswing phase there is an average shoulder joint angle of 65.1/73.6 degrees, an average elbow joint angle of 173.3/174.1 degrees, an average wrist joint angle of 139.4/134.1 degrees, an average waist joint angle of 136.2/135.4 degrees, an average knee joint angle of 166.6/167.1 degrees, an average backswing movement time of 2.64/3.07 s, an average distance between the starting phase to the backswing phase of 185.67/91.29 centimeters and an average height ball 131.95/133.12 centimeters. The backswing phase is used to get a swing movement when performing the next phase of movement. The longer the backswing distance, the longer the swing movement, and the less right-hand muscle/touch style is used. The backswing phase affects the movement of the next phase.

The swing phase movement in petanque shooting is the movement of swinging the hand forward from the backswing movement. The swing phase is used to get the swing movement when performing the next phase of movement. Swing movement will be affected by the length of the arm, the longer one's arm will be the longer the distance needed and the shorter one's arm will be the shorter the distance needed. To get a carreau shot at a distance of 6 and 7 meters in petanque sports in the swing phase there is an average shoulder joint angle of 76.5/79.0 degrees, an average elbow joint angle of 173.6/175.3 degrees, an average wrist joint angle of 164.9/163.2 degrees, an average waist joint angle of 147.5/153.1 degrees, an average knee joint angle of 154.0/159.4 degrees, an average time of 0.42/0.42 s, an average distance for swing movements of 135.18/118.36 centimeters and an average ball height of 66.45/70, 69 centimeters. The longer the swing distance, the longer the swing movement will be and the less right-hand muscle/touch force. The swing phase affects the movement of the next phase.

The release phase movement in petanque shooting is the movement of releasing the ball from the palm. The release phase is no less important than the previous phases because it is used to obtain the release of the ball according to the purpose or distance available. To get a carreau shot at a distance of 6 and 7 meters in petanque sports in the release phase there is an average shoulder joint angle of 94.1/100.4 degrees, an average elbow joint angle of 171.5/173.6 degrees, an average wrist joint angle of 148.4/153.2 degrees, an average waist joint angle of 148.1/152.9 degrees, an average knee joint angle of 156.0/159.5 degrees, an average time of 0.03/0.03 s s, an average distance for release movements of 26.66/25.24 centimeters and an average ball height of 80.08/84.95 centimeters. The longer the release distance, the longer the swing movement and the less muscle strength/touch force of the right hand. The release phase affects the direction in which the ball is released. In simple terms, to produce a straight shot, the phase of the backswing movement until the release movement must also be straight in the direction according to the desired target. Based on the discussion, it is important to analyze biomechanics when shooting series in petanque sports to produce optimal performance. Shooting carreau is the main goal of petanque players because the shooting has the highest score. In shooting, there are three phases including the backswing phase, the swing phase, and the release phase. Each such phase has different characteristics of angle, time, speed, distance, and height of the ball. These characteristics will affect the muscle/touch force of the hand and affect the maximum ball height and the final speed of the ball with a certain distance which will later produce shooting according to the purpose.

CONCLUSION

Backswing movement phase distance 6 meters obstacle 1 carreau shot with an average velocity of 0.85 m/s. and a standard deviation of ± 0.42 m/s. Swing movement phase distance 6 meters obstacle 1 carreau shot with an average velocity of 3.26 m/s. and a standard deviation of ± 0.67 m/s. Release movement phase distance 6 meters obstacle 1 carreau shot with an average velocity of 8.89 m/s. and a standard deviation of ± 0.75 m/s. Backswing movement phase distance 7 meters obstacle 1 carreau shot with an average velocity of 0.36 m/s. and a standard deviation of ± 0.19 m/s. Swing movement phase distance 7 meters obstacle 1 carreau shot with an average velocity of 2.81 m/s. and a standard deviation of ± 0.25 m/s. Release movement phase distance 7 meters obstacle 1 carreau shot with an average velocity of 8.41 m/s. and a standard deviation of ± 0.46 m/s. It is very important to pay attention to the initial internal factors before practicing for the next stage. The results in this article can be used as a reference to train petanque athletes to provide optimal performance.

ACKNOWLEDGEMENT

REFERENCES

Alimuddin, Hasyim, N., Liza, & Nopiyanto, Y. E. (2021). Peningkatan Pembelajaran Dasar Long Serve Menggunakan Metode Inquiry Dalam Permainan Bulutangkis. *Journal of Sport Education (JOPE)*, *3*(2), 63–74.

Ardhiyanto, S., Widiyatmoko, F. A., & Zahraini, D. A. (2021). Analisis backswing dan release ketepatan shooting dalam olahraga petanque. *Journal of Physical Activity and Sports (JPAS)*, *2*(2), 171–179. https://doi.org/10.53869/jpas.v2i2.69

Azahrah, F. R., Afrinaldi, R., & Fahrudin. (2021). Keterlaksanaan Pembelajaran Bola Voli Secara Daring pada SMA Kelas X Se-Kecamatan Majalaya. *Jurnal Ilmiah Wahana Pendidikan*, *7*(4).

Bustomi, A. O., Hidayah, T., Okilanda, A., & Putra, D. D. (2020). Analisis Gerak Pointing Pada Olahraga Petanque. *Journal Sport Area*, *5*(1), 65–75. https://doi.org/10.25299/sportarea.2020.vol5(1).4807

Dyky, I. R., & Kusuma, I. D. M. A. (2021). Analisis Biomekanika Shooting Pada Atlet Ukm Futsal Universitas Negeri Surabaya. *Jurnal Prestasi Olahraga*, *4*(3), 101–106. https://ejournal.unesa.ac.id/index.php/jurnal-prestasi-olahraga/article/view/38691%0Ahttps://ejournal.unesa.ac.id

Emery, C. A., & Tyreman, H. (2009). Sports Participation, Sports Injury, Risk Factors and Sports Safety Practices in Calgary and Area Junior High Schools. *Paediatrics and Child Health*, *14*(7), 439–444. https://doi.org/10.1093/pch/14.7.439

Faoziyah, N., & Suharjana. (2020). Kualitas dan efisiensi tidur yang buruk pada mahasiswa olahraga tahun pertama srata-1 terhadap pembelajaran gerak. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran*, *6*(2), 514–525. https://doi.org/10.29407/js_unpgri.v6i2.14545

Friskawati, G. F., & Supriadi, D. (2022). Video analysis with YouTube platform for Physical Education, Health, and Recreation students's Higher Order Thinking Skills (HOTs). *Journal Sport Area*, *7*(1), 96–103. https://doi.org/10.25299/sportarea.2022.vol7(1).7737

Gilles, S. (2015). *The Winning Trajectory*. Copy Media.

Hammed, I. A., Kubeyinje, O. S., Oyakhire, A., Adebimpe, D., & Onyemechi, E. (2023). Effects of Cryokinetics on Hand Function of Patients with Spinal Cord Injury. *Journal of Anthropology of Sport and Physical Education*, *7*(2), 3–7. https://doi.org/10.26773/jaspe.230401

Irawan, F. A., & Ghassani, D. S. (2022). *ANALISIS GERAK POINTING PETANQUE POSISI BERDIRI PADA ATLET KLUB ACPC DI KOTA SEMARANG.*

Irawan, F. A., Ghassani, D. S., Permana, D. F. W., Kusumawardhana, B., Saputro, H. T., Fajaruddin, S., & Bawang, R. J. G. (2022). Analysis of pointing accuracy on petanque standing position: Performance and accuracy. *Journal Sport Area*, *7*(3), 456–465. https://doi.org/10.25299/sportarea.2022.vol7(3).10183

Irawan, F. A., Ma'dum, M. A., Indardi, N., Trans, M. N. Le, & Fatmasari, A. P. (2022). Potential and

limitations of short backhand serve in badminton: Kinematics analysis. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran*, 8(4), 342–354. https://doi.org/10.29407/js_unpgri.v8i4.18383

Irawan, F. A., & Munir, A. S. (2022). Analisis Backswing Dan Penggunaan Star Excursion Balance Test (SEBT) Terhadap Hasil Lemparan Shooting Petanque. *JOSSAE Journal of Sport Science and Education*, 197–204. https://doi.org/10.26740/jossae.v6n2.p197-204

Irawan, F. A., & Paulina, jelita D. (2022). *Analisis Gerak Pointing Dengan Posisi Jongkok Semarang*. Universitas Negeri Semarang.

Irawan, F. A., Permana, D. F. W., Akromawati, H. R., & Yang-Tian, H. (2019). Biomechanical Analysis of Concentration and Coordination on The Accuracy in Petanque Shooting. *Journal of Physical Education, Sport, Health and Recreation*, 8(2), 96–100. http://journal.unnes.ac.id/sju/index.php/peshr

Irawan, F. A., Permana, D. F. W., Yuwono, Asnawi, S., Pamungkas, A. T., Yunior, A. B. S., & Baktiyaningsih, L. (2021). Permainan Hadang Sebagai Media KPOTI Dalam Peningkatan Aktivitas Fisik Melalui Lestari Budayaku Bugar Bangsaku. *Journal of Sport Education (JOPE)*, 3(2), 63–74.

Irawan, F. A., & Prastiwi, T. A. S. (2022). Biomechanical analysis of the three-point shoot in basketball: shooting performance. *Journal of Physical Education and Sport*, 22(12), 3003–3009. https://doi.org/10.7752/jpes.2022.12379

Jariono, G., Indarto, P. N., Hendarto, S., Nugroho, H., & Fachrezy, F. (2020). Analisis kondisi fisik menggunakan software Kinovea pada atlet taekwondo Dojang Mahameru Surakarta. *Transformasi: Jurnal Pengabdian Masyarakat*, 16(2), 133–144. https://doi.org/10.20414/transformasi.v16i2.2635

Ma'dum, M. A., & Irawan, F. A. (2021). Analisis Gerak Backhand Short Serve Pada Atlet Bulutangkis. *Journal of Sport Education (JOPE)*, 5(2), 63–74.

Maffulli, N., Longo, U. G., Gougoulias, N., Caine, D., & Denaro, V. (2011). Sport Injuries: A Review of Outcomes. *British Medical Bulletin*, 97(1), 47–80. https://doi.org/10.1093/bmb/ldq026

Okilanda, A., Arisman, Lestari, H., Lanos, M. E. C., Fajar, M., Putri, S. A. R., & Sugarwanto. (2018). Sosialisasi Petanque Sebagai Olahraga Masa Kini. *Jurnal Bagimu Negeri*, 2(1), 69–76. https://doi.org/10.26638/jbn.638.8651

Pasaribu, A. M. N., Candra, J., Kamsurya, R., Zainur, Nurkadri, & Laksana, A. A. N. P. (2021). The relationship of motor skills with performance: Meta-analysis study. *Journal Sport Area*, 6(3), 315–324. https://doi.org/10.25299/sportarea.2021.vol6(3).6647

Pelana, R. (2016). Hubungan Kekuatan Otot Tungkai Dan Keseimbangan Statis Dengan Hasil Shooting Pada Atlet Klub Petanque. *Prosiding Seminar Nasional Maret 2016*, 116–127. http://pasca.um.ac.id/conferences/index.php/SNPJ/article/download/996/667

Pratiwi, F. Z., Setijono, H., & Fuad, Y. (2018). *Pengaruh Latihan Plyometric Front Cone Hops Dan Counter Movement Jump Terhadap Power Dan Kekuatan Otot Tungkai*.

Rahman, F. J. (2018). Peningkatan Daya Tahan, Kelincahan, dan Kecepatan pada Pemain Futsal: Studi Eksperimen Metode Circuit Training. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran*, 4(2), 264. https://doi.org/10.29407/js_unpgri.v4i2.12466

Rezki. (2016). Analisis Gerak Motorik Dasar Siswa Kelas VII SMP Negeri 1 Kecamatan Kuok Kabupaten Kampar. *Journal Sport Area*, 1(1), 63. https://doi.org/10.30814/sportarea.v1i1.375

Rusdiana, A., Sartono, H., Nurjaya, D. R., & Angga, M. (2019). *Analysis perbedaan long drive swing mechanical movement terhadap ball velocity berbasis pendekatan kinematics analysis antara skill dan unskill golf player Difference analysis of long drive swing mechanical movement towards ball velocity based on analysis*.

Sabilla, N. P., Rahayuni, K., & Hanief, Y. N. (2021). Pengembangan Latihan Imagery Untuk Meningkatkan Kepercayaan Diri Pada Atlet Renang Usia Remaja Di Garuda Aquatic Swimming Club Kabupaten Kediri. *Journal of Sport Education (JOPE)*, 3(2), 63–74.

Santoso, D. A., & Setiabudi, M. A. (2019). The analysis of biomechanics on footwork step pattern spike toward power spike of volleyball sport. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran*, 5(1), 29. https://doi.org/10.29407/js_unpgri.v5i1.12500

Sinaga, F. S. G., & Ibrahim. (2019). Analysis Biomechanics Pointing dan Shooting Petanque Pada Atlet TC PON XX PAPUA. *Sains Olahraga : Jurnal Ilmiah Ilmu Keolahragaan*, 3(2), 66. https://doi.org/10.24114/so.v3i2.15196

Surahman, F. (2020). Analisis Gerak Teknik Renang Gaya Punggung PadaMahasiswa Jurusan Kepelatihan Olahraga FIK UNP. *Journal Sport Area*.

Terok, E. R., & Huwae, A. (2021). Motivasi Berprestasi Atlet Bulutangkis Di Kabupaten Tolitoli Ditinjau

Dari Bentuk Dukungan Sosial. *Journal of Sport Education (JOPE)*, *3*(2), 63–74.

Wahyunal, & Gazali, N. (2021). Kajian Penelitian Literatur Review: Metode Student Teams Achievement Division Dalam Pendidikan Jasmani. *Journal of Sport Education (JOPE)*, *3*(2), 63–74. https://jope.ejournal.unri.ac.id/index.php/jope/article/view/7947/6856

Wijaya, M. R. A., Bachtiar, Mahardika, N. A., Firmansyah, D., & Vai, A. (2021). Profil Fleksibilitas Kaki, Pinggul dan Punggung Atlet Pencak Silat Klub PSP. *Journal of Sport Education (JOPE)*, *3*(2), 63–74.

Wisnu, H. (2022). *Kajian Penelitian Pembelajaran Pendidikan Jasmani: Quantum Learning Atau Blended Learning*. *5*, 58–68. http://dx.doi.org/10.31258/jope.5.1.58-68