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Differences in motion analysis jump shot with and without opponent on level of success basketball athlete

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Abstract
One of the most dangerous shooting techniques is the jump shot, which can be performed in various positions and is difficult to block. This research aims to analyze various factors, such as knee angle, jump height, body tilt, arm angle, wrist angle, and maximum height of the ball, to compare jump shot movements without an opponent and with an opponent. This research uses a quantitative-qualitative design and uses comparative analysis. Five subjects were allowed to experiment ten times, and data was collected using dartfish software. The results of the study found an increase in the knee angle when jump shot with an opponent's obstacle of 10.6º, which increases jump height by 5 cm when there is an opponent's obstacle. For the current body tilt angle jump shot with the opponent's resistance increasing to 2.4º. The angle of the elbow when there is an opponent's obstacle is greater at around 3.4º, while the angle of the wrist when there is an opponent's obstacle is smaller at around 7.9º, and the height of the ball when there is an opponent's obstacle appears to be around 8 cm higher. Based on this, to increase success jump shot an athlete must always train using an opponent, in order to adapt to the situation during the match and maximize movement jump shot.

Keywords: Analysis, biomechanics, technique, shooting, jump shot, basketball, dartfish

1. Introduction
Basketball is a type of sport whose development is increasing. Basketball is one of the most popular types of ball sports. The sport of basketball is played with hands and is played by two teams, each with five athletes. The goal is to score points in the opposing team's basket and prevent the opposing team from scoring points (Gómez *et al*., 2015) [7].
To win games and achieve the goal of scoring as many balls as possible, technique is very important for every basketball athlete. Shooting skills are the most important part and directly influence the percentage of points scored to win a match (Taufik *et al*., 2021) [21]. Score productivity is directly proportional to the athlete's ability in basic techniques in basketball matches, so that athletes can make effective and efficient movements (Stojanović *et al*., 2018) [20] (Clementswami & Sugumar, 2023) [5].
One very dangerous shooting technique is the jump shot. This shot is done when jumping at the highest point, is difficult to block, and can be done in various positions (Caseiro *et al*., 2023) [4] (Vencúrik *et al*., 2021) [23]. Athletes who can release the ball from various distances will be very advantageous in basketball matches (Victor H A Okazaki *et al*., 2015) [16].
A report from the National Basketball Association (NBA) shows that 58.8% of all NBA teams scored points during a game using ball shots, and 29.5% of all ball shots were made after receiving a ball pass. Empirical facts show that 60% of field goals in basketball games come from ball shots (Conte *et al*., 2018) [6]. Based on this data, it can be concluded that the jump shot is one of the most important ball shooting techniques and has a huge influence on the victory of a basketball team.
Jump shot means the ball is released into the air, the release of the ball usually occurs near the top of the vertical path when the athlete jumps (Penner, 2021) [18]. If an athlete can shoot a jump shot well, it can be a threat to their opponents.

Because athletes try to release the ball faster and from a higher position when facing an opponent, this strategy can reduce the opponent's opportunity to stop the ball, and the shooter's success depends on the speed and height of the ball release (Inaba *et al*., 2017) [10]. The results of biomechanical studies show that jump shots are influenced by the speed, angle and height of the ball released (Nakano *et al*., 2020) [14]. The factors that influence the movement patterns used by players when taking a jump shot show how complex the importance of this movement is in the sport of basketball (Gorman & Maloney, 2016) [8]. Variables such as the ball's release height, angle and speed at which the ball is shot also play a role (Khazaeli *et al*., 2015) [12]. From this statement it is clear that the team's success can be supported by the application of sports science and sports biomechanics (Zhen *et al*., 2015) [24].

Dartfish is a program that can help in analyzing movements. This program allows users to make decisions that can improve athlete performance (Buscà Safont-Tria *et al*., 2016) [2]. Video analysis is commonly used in the field of sports, namely studying basic movements and techniques in a sport which is assisted by features in the program.

2. Materials and Methods

Research methods are scientific techniques for collecting data for specific purposes and objectives (Kapur, 2018) [11]. This research uses a quantitative-qualitative approach, and uses comparative analysis. Knee angle (SL), jump height (KL), body tilt angle (SKB), elbow angle (SK), wrist angle (SPT), and maximum ball height (KMB) are all data obtained from the Dartfish program analysis. This research uses a proportional purposive technique to select subjects. Subjects were men aged 20 to 23 years, played predominantly with their right hand, and had been practicing for 4-6 years. Thus, the number of subjects was 5 people.

The instrument used in this research is dartfish software. To support the data collection process, equipment and materials are also used such as DSLR cameras, standard size basketballs, cones, statues/dolls (as opponents), stationery and biodata sheets as well as research variable measurement sheets. The placement of the camera must be able to record the athlete's movement and the trajectory of the ball towards the rim, the distance between the camera and the athlete is 12 m, the height of the camera is 1.1 m, the calibrating ruler is 60 cm long, the height of the dummy/opponent is 2.1 m and the distance the athlete performs jump shot with the rim 5 meters, while the distance between the athlete and the opponent is 1 m. For data collection, each five subjects were given ten trials, five jump shots each without an opponent in the way and five jump shots in the face of an opponent. After the data is obtained as explained in the data collection stage, it will be continued by using dartfish software, the researcher analyzes the jump shot movements in detail based on the variables studied**.** Each subject was gathered and given instructions on what to do. After that, the subject warms up and prepares to record the jump shot movement. Each subject performed five attempts without an opponent's resistance, and five times with an opponent's resistance, with the subject's position behind the free throw line. The recording process stops once the last ball hits the floor. After the recording process, the activity was closed at the end with the subject cooling down.

After the video is finished, Dartfish software is used to measure each variable. Each incoming ball is given a score according to how precisely the ball enters the rim. This value is used to score each shot, which is based on whether the ball was a success if it went into the rim or a failure if it didn't. The measurement results are followed by quantitative data processing, resulting in research conclusions.

3. Results and Discussion

To make the research analysis easier to understand and conclude, the research results will be presented in table form according to the instruments that have been explained. The data presented comes from measurements taken on five subjects during the jump shot. The variables reviewed include foot angle, jump height, body tilt angle, arm angle, wrist angle, and maximum ball height. The results of data recapitulation from the results of measuring jump shot movements using dartfish are presented in tabular form. The following are the data results from dartfish for the jump shot movement without an opponent and with an opponent.

3.1 Jump shot data without an opponent

The results of research data analysis showed that subject FP succeeded in entering the ball 4 times, subject ARA succeeded in entering the ball 3 times, subjects ALA and AV succeeded in entering the ball 2 times and subject MN did not succeed in entering the ball. This can be seen in the following Tables.

Table 1: ALA Subjects

Trial	Variables						Accuracy
	SL	AT	SKB	SS	SPT	KB	
1	87,3	28	1,8	64,7	146,3	423	Fail
2	74,4	26	3,4	71	125,2	403	Fail
3	74,9	29	1,7	76,1	128,2	413	Fail
4	71,3	29	3,8	83	118,3	417	Succeed
5	72,6	28	2,4	77	118,6	421	Succeed
x̄	76,10	28,00	2,62	74,36	127,32	415,40	Successful 2; Fail 3
p	6,42	1,22	0,94	6,88	11,43	7,92	
Max	87,30	29,00	3,80	83,00	146,30	423,00	
Min	71,30	26,00	1,70	64,70	118,30	403,00	

In the data in table 1 for successful attempts, the researcher can state that subject ALA succeeded in entering the ball twice, namely on the fourth and fifth attempts. Based on successful trials, when performing the jump shot the subject formed a knee angle of 71.3º-72.6º, which resulted in a jump height of between 28-29 cm, the angle of inclination of his body while in the air was between 2.4º-3.8º, the elbow angle before release is between 77-83º and the wrist angle before release is between 118.3-118.6 º, which results in a maximum ball height of 417-421 cm.

Table 2: ARA Subjects

Trial	Variables						Accuracy
	SL	AT	SKB	SS	SPT	KB	
1	75,2	22	4,9	72,8	121,4	392	Succeed
2	82,1	20	8,2	68,4	142,2	412	Succeed
3	75,9	23	1,9	62,2	134	386	Fail
4	80,3	19	4,8	67,8	135	410	Fail
5	78,8	17	2,4	73,6	118,8	407	Succeed
x̄	78,46	20,20	4,44	68,96	130,28	401,40	Successful 3; Fail 2
p	2,91	2,39	2,50	4,57	9,86	11,65	
Max	82,10	23,00	8,20	73,60	142,20	412,00	
Min	75,20	17,00	1,90	62,20	118,80	386,00	

In the data in table 2 for successful attempts, the researcher can state that subject ARA succeeded in entering the ball

three times, namely on the first attempt second and fifth. Based on successful trials, when performing the jump shot the subject formed a knee angle of 75.2º-82.1º, which resulted in a jump height of between 17-22 cm, the angle of inclination of his body while in the air was between 2.4º-8.2º, the elbow angle before release is between 68.2º-73.6º and the wrist angle before release is between 118.8º-142.2º, which results in a maximum ball height of 392-412 cm.

Table 3: Subject AV

Trial	Variables						Accuracy
	SL	AT	SKB	SS	SPT	KB	
1	102,7	18	5,4	62,6	108,3	386	Fail
2	86,6	22	3,5	75,7	98,5	382	Succeed
3	81,6	23	4,3	71,2	102,7	384	Fail
4	87,8	22	4,6	77,9	95,9	359	Succeed
5	81,4	20	2,8	62	103,9	384	Fail
x̄	88,02	21,00	4,12	69,88	101,86	379,00	Successful 2; Fail 3
p	8,70	2,00	1,00	7,33	4,83	11,27	
Max	102,70	23,00	5,40	77,90	108,30	386,00	
Min	81,40	18,00	2,80	62,00	95,90	359,00	

In the data in table 3 for successful attempts, the researcher can state that subject AV succeeded in entering the ball twice, namely on the second and fourth attempts. Based on successful trials, when performing a jump shot the subject formed a knee angle of 86.6º-87.8º, which resulted in a jump height of between 22 cm, the angle of inclination of his body while in the air was between 3.5º-4.6º, the angle The elbow before release is between 75.7º-77.9º and the wrist angle before release is between 95.9º-98.5º, which results in a maximum ball height of 359-382 cm.

Table 4: FP Subjects

Trial	Variables						Accuracy
	SL	AT	SKB	SS	SPT	KB	
1	88	38	7,3	68,7	122,8	407	Succeed
2	77,6	38	7,1	65,8	128,8	396	Fail
3	84,6	40	8,9	70,9	125,7	387	Succeed
4	86,8	40	9	82,7	109,8	387	Succeed
5	83,3	39	10,4	75,1	109,2	392	Succeed
x̄	84,06	39,00	8,54	72,64	119,26	393,80	Successful 4; Fail 1
p	4,05	1,00	1,36	6,57	9,16	8,29	
Max	88,00	40,00	10,40	82,70	128,80	407,00	
Min	77,60	38,00	7,10	65,80	109,20	387,00	

In table 4 data for successful attempts, the researcher can explain that subject FP succeeded in entering the ball four times, namely on the first, third, fourth and fifth attempts. Based on successful trials, when performing a jump shot the subject formed a knee angle of 83.3º-88º, which resulted in a jump height of between 38-40 cm, the angle of inclination of his body while in the air was between 7.3º-10.4º, the angle The elbow before release is between 68.7º-82.7º and the wrist angle before release is between 109.2º-125.7º, which results in a maximum ball height of 387-407 cm.

Table 5: MN Subjects

Trial	Variables						Accuracy
	SL	AT	SKB	SS	SPT	KB	
1	96,1	23	6,6	63,3	120	426	Fail
2	95,2	25	4,4	64	114,4	406	Fail
3	93,2	25	6,7	63,4	113,3	392	Fail
4	102,2	23	6,8	64,3	117,3	380	Fail
5	100	25	5,7	70,3	103,9	395	Fail
x̄	97,34	24,20	6,04	65,06	113,78	399,80	Successful 0; Fail 5
p	3,67	1,10	1,02	2,96	6,11	17,33	
Max	102,20	25,00	6,80	70,30	120,00	426,00	
Min	93,20	23,00	4,40	63,30	103,90	380,00	

In the data in table 5, it can be seen that subject MN did not succeed in scoring a single ball. Where 3 of his attempts failed after bouncing into the ring or board and 2 of his attempted shots were airballs/didn't touch the ring or board.

3.2 Jump shot data with the opponent

The results of research data analysis showed that subject MN succeeded in entering the ball 4 times, subjects AV and FP succeeded in entering the ball 3 times, subject ALA succeeded in entering the ball 2 times and subject ARA did not succeed in entering the ball. This can be seen in the following tables.

Table 6: ALA Subjects

Trial	Variables						Accuracy
	SL	AT	SKB	SS	SPT	KB	
1	71,9	35	3	62,7	141,3	426	Fail
2	71	31	2,2	72,4	134,3	429	Succeed
3	69,8	35	1,4	71,8	112,2	426	Fail
4	90,4	31	3,9	71,2	117,1	429	Fail
5	72,6	28	2,4	77	118,6	421	Succeed
x̄	75,14	32,00	2,58	71,02	124,70	426,20	Successful 2; Fail 3
p	8,59	3,00	0,93	5,18	12,44	3,27	
Max	90,40	35,00	3,90	77,00	141,30	429,00	
Min	69,80	28,00	1,40	62,70	112,20	421,00	

In table 6 data for successful attempts, the researcher can explain that subject ALA succeeded in entering the ball twice, namely on the second and fifth attempts. Based on successful trials, when performing the jump shot the subject formed a knee angle of 71.9º-72.6º, which resulted in a jump height of between 28-31 cm, the angle of inclination of his body while in the air was between 2.2º-2.4º, the elbow angle before release is between 72.4º-77º and the wrist angle before release is between 118.6º-134.3º, which results in a maximum ball height of 421-429 cm.

Table 7: ARA Subjects

Trial	Variables						Accuracy
	SL	AT	SKB	SS	SPT	KB	
1	71,4	28	5,4	63,7	126,1	389	Fail
2	73,3	26	3,6	64,2	126,2	401	Fail
3	74,1	27	4,3	74,2	134,4	403	Fail
4	77	29	4,6	70	125	386	Fail
5	82	25	7,8	62,6	139,4	406	Fail
x̄	75,56	27,00	5,14	66,94	130,22	397,00	Successful 0; Fail 5
p	4,13	1,58	1,62	4,97	6,37	8,92	
Max	82,00	29,00	7,80	74,20	139,40	406,00	
Min	71,40	25,00	3,60	62,60	125,00	386,00	

In the data in table 7 it can be seen that subject ARA did not succeed in scoring a single ball. Where 2 of his attempts failed after bouncing into the ring, 1 attempted shot hit the board but didn't go in and 2 attempted shots were airballs/didn't touch the ring or board.

Table 8: Subject AV

Trial	Variables						Accuracy
	SL	AT	SKB	SS	SPT	KB	
1	83,9	28	3,8	78,4	115,3	363	Succeed
2	80,9	31	3,4	70,1	113,8	369	Fail
3	87,5	27	2,8	72	119,3	381	Succeed
4	89,4	25	3,9	65,9	131,9	373	Fail
5	83,3	25	3	73,4	101,4	379	Succeed
x̄	85,00	27,20	3,38	71,96	116,34	373,00	Successful 3; Fail 2
p	3,41	2,49	0,48	4,58	10,97	7,35	
Max	89,40	31,00	3,90	78,40	131,90	381,00	
Min	80,90	25,00	2,80	65,90	101,40	363,00	

In table 8 data for successful attempts, the researcher can state that subject AV succeeded in entering the ball three times, namely on the second and fourth attempts. Based on successful trials, when performing the jump shot the subject formed a knee angle of 83.3º-87.5º, which resulted in a jump height of between 25-28 cm, the angle of inclination of his body while in the air was between 2.8º-3.8º, the elbow angle before release is between 72º-78.4º and the wrist angle before release is between 101.4º-119.3º, which results in a maximum ball height of 363-381 cm.

Table 9: FP Subjects

Trial	Variables						Accuracy
	SL	AT	SKB	SS	SPT	KB	
1	78	43	12,4	79,1	104,4	392	Succeed
2	80,7	45	11,8	75,9	117,3	398	Succeed
3	81,8	42	7,4	71,5	117,9	420	Fail
4	82,8	43	7,5	67,7	123,4	391	Fail
5	84	42	4,3	86,4	117,3	401	Succeed
x̄	81,46	43,00	8,68	76,12	116,06	400,40	Successful 3; Fail 2
p	2,29	1,22	3,38	7,19	7,01	11,72	
Max	84,00	45,00	12,40	86,40	123,40	420,00	
Min	78,00	42,00	4,30	67,70	104,40	391,00	

In table 9 data for successful attempts, the researcher can explain that subject FP succeeded in entering the ball three times, namely on the first, second and fifth attempts. Based on successful trials, when performing a jump shot the subject formed a knee angle of 78º-84º, which resulted in a jump height of between 42-45 cm, the angle of inclination of the body while in the air was between 4.3º-12.4º, the angle of the elbow before release between 75.9º-86.4º and wrist angle before release between 104.4º-117.3º, which results in a maximum ball height of 392-401 cm.

Table 10: MN Subjects

Trial	Variables						Accuracy
	SL	AT	SKB	SS	SPT	KB	
1	93,4	29	4,5	63,8	118,2	380	Succeed
2	96,2	26	5,1	65,9	107,7	382	Succeed
3	98,6	31	6,8	61,7	116,6	385	Succeed
4	100,4	26	6,2	60,8	118,4	383	Fail
5	93,6	26	5,7	68,8	121,2	384	Succeed
x̄	96,44	27,60	5,66	64,20	116,42	382,80	Successful 4; Fail 1
P	3,07	2,30	0,90	3,24	5,15	1,92	
Max	100,40	31,00	6,80	68,80	121,20	385,00	
Min	93,40	26,00	4,50	60,80	107,70	380,00	

In table 10 data for successful attempts, the researcher can explain that subject MN succeeded in entering the ball four times, namely on the first, second, third and fifth attempts. Based on successful trials, when performing the jump shot the subject formed a knee angle of 93.4º-98.6º, which resulted in a jump height of between 26-31 cm, the angle of inclination of his body while in the air was between 4.5º-6.8º, the elbow angle before release is between 61.7º-68.8º and the wrist angle before release is between 107.7º-121.2º, which results in a maximum ball height of 380-385 cm.

4. Discussion

Jump shot is one of a kind shooting by adding a jump when doing it, where the ball is released at the highest point of the jump. In general, mechanisms jump shot similar to a set shoot or free throw. One of the main differences is that the shot is taken at the highest height of the jump (Ogawa *et al*., 2019) [15]. Technique jump shot is a type of shoot that adds a jump when doing it, where the ball is released at the highest point of the jump, to avoid the opponent (Victor Hugo Alves Okazaki & Rodacki, 2018) [17] (Sofyan & Budiman, 2022) [19]. There are several Newton's laws that work when doing a jump shot. Newton's laws apply when the ball remains stationary in the athlete's grasp before being released. Additionally, Newton's second law applies when the ball is released from rest and then pushed to release it Once released, the ball will move at a constant speed until the gravitational force reaches its highest point. The hands will push the ball to move. If the ring is close to the athlete, the force applied should be less so that the ball does not move as quickly. On the other hand, if the ring is far away, the force applied must be greater so that the ball can move quickly. However, Newton's law II applies before the athlete jumps into the air: the athlete reacts by channeling force downwards or into the ground, thus creating a reaction with the same force upwards or into the air. Apart from that, this law also applies when an athlete performs an action by pushing the ball, so that the ball leaves its stationary position, or in his hand.

Based on existing research data, the success of the ALA subject in entering the ball without an opponent blocking it and with an opponent blocking it, has the same level of success, namely 2 times entering. If we look at the variables studied, the knee angle during a jump shot without an opponent and with an opponent is not too different, while the jump height is only slightly different, increasing by around 2 cm when there is an opponent. Even though the angle of the body tilt when jumping doesn't change much, when there is an opponent's obstacle, the body tilt is more stable. The position of the hand when in the air, the angle of the elbow when the opponent is facing the opponent, looks smaller, while the angle of the wrist looks like there is a big change. With the opponent's obstruction, the ball released is about 8 cm higher.

The success of the ARA subject in entering the ball without the opponent's obstruction and with the opponent's obstruction, experienced a very large decrease in success rate, namely from 3 entries to none at all. If we look at the variables studied, the knee angle during a jump shot without an opponent and with an opponent is not too different, while the jump height increases by around 7 cm when there is an opponent. The angle of inclination of the body during a jump shot without an opponent and with an opponent is not too different. The position of the hand when in the air, the angle of the elbow when an opponent is facing it is not too different, it looks slightly bigger at around 0.6º, while the angle of the wrist doesn't look too different. The height of the ball when

the opponent hits it, it can be seen that the ball being released is around 10 cm lower. This was one of the obstacles to why the ball didn't go in, because it looked like some of the balls that were released were airballs and some touched the edge of the ring and the ball came out.

Subject AV's success in entering the ball without an opponent blocking it and with an opponent blocking it has increased, namely from 2 times entering to 3 times entering. If we look at the variables studied, the knee angle during a jump shot in the face of an opponent, although not too different, can be seen to be a smaller angle of around 3.3º, while the height of the jump increases by around 6 cm when there is an opponent's face. The angle of inclination of the body when jumping is not too different. The position of the hand when in the air, the angle of the elbow when an opponent is facing it, is not too different, while the angle of the wrist shows a big change, namely around 20.8º. Even with the opponent's obstruction, the ball released does not differ in height too much.

The success of the FP subject in entering the ball without an opponent blocking it and with an opponent blocking it, experienced a very large decrease in the success rate, namely from 4 times entering to 3 times entering. If we look at the variables studied, the knee angle during a jump shot in the face of an opponent decreases by 5.3º, while the height of the jump increases by around 5 cm when there is an opponent's face. The tilt angle of the body during a jump shot against an opponent increases to 2.4º. The position of the hand when in the air, the angle of the elbow when an opponent is facing it is around 3.7º greater, while the angle of the wrist doesn't look too different. The height of the ball when the opponent hits it doesn't look too different.

Subject MN's success in entering the ball without the opponent's obstruction and with the opponent's obstruction increased, namely from not entering at all to 4 times entering. If you look at the variables studied, the knee angle during a jump shot when facing an opponent doesn't look too different, while the height of the jump increases by around 6 cm when there is an opponent facing you. As for the angle of inclination of the body when jumping, it doesn't look too different. The position of the hand when in the air, the angle of the elbow when the opponent is facing it, doesn't look too different, while the angle of the wrist doesn't look too different either. Even with the opponent's obstruction, the ball released does not differ in height too much.

Based on successful trials, when performing a jump shot without an opponent in the way, the subject formed a knee angle of 71.3º-88º, which resulted in a jump height of between 17-40 cm, the angle of inclination of his body while in the air was between 2.4º-10.4º, the elbow angle before release is between 68.4º-83º and the wrist angle before release is between 95.9º-142.2º, which results in a maximum ball height of 359-421 cm. Meanwhile, in the successful attempt, when taking a jump shot against an opponent, the subject formed a knee angle of 71º-98.6º, which resulted in a jump height of between 25-45 cm, the angle of inclination of his body while in the air was between 2.2º-12.4º, the elbow angle before release is between 61.7º-86.4º and the wrist angle before release is between 101.4º-134.3º, which results in a maximum ball height of 363-429 cm.

If we look at the variables studied, the difference in the jump shot movement between without an opponent and with an opponent in the presence of an opponent, there is an increase in the knee angle during a jump shot with an opponent in the presence of an opponent of 10.6º, this is in line with (Vencúrik *et al*., 2021) [23] stating the level successful implementation shooting with a leg angle of approximately 104.4°, apart from bending the knees, swinging the arms can help achieve a higher jump height (Theodorou *et al*., 2022) [22], so that athletes can do it more safely shooting even though there are opponents standing in the way. The trajectory of the ball has been proven to be influenced by the angle of release, speed and height of release (Cabarkapa *et al*., 2023) [3], therefore an athlete when making a jump shot must jump higher or maximally, where in this study the height of his jump increased by around 5 cm when there is an opponent's obstacle.

The angle of inclination of the body during a jump shot against an opponent increases to 2.4º, which means that the athlete's body position in the air is not yet stable, this can affect the accuracy of the shot. To produce an effective ball release angle and the ball enters successfully, the arm position must form an L shape or an effective arm angle close to 90° (Hassan *et al*., 2023) [9] (Aksoy, 2023) [1]. Apart from that, the release phase carried out at the follow through position stage is also carried out optimally and not in a rush so that the ball's speed can be controlled properly. This is in accordance with research results, when in the air the angle of an athlete's elbow when an opponent is facing it is around 3.4º greater.

Meanwhile, the angle of his wrist when facing an opponent is smaller, around 7.9º, which is useful when releasing the ball towards the ring. After the ball is released, move your hands towards the ring and keep your elbows locked and use the final force of the wrist push. For the height of the ball when the opponent is blocking it, it appears that the height of the ball is around 8 cm higher. Based on this, to increase the success of jump shots, an athlete must always practice using an opponent, in order to adapt to the situation during the match and maximize the jump shot movement.

Apart from these biomechanical factors, there are other components that are very important for the success of the ball entering. One of them is shooting rhythm or synchronization between the legs, waist, shoulders, shooting elbow, wrist flexibility and fingers when the ball goes in (Khi *et al*., 2023) [13]. So, synchronization of the lower body to the upper body is very important. Additionally, for an effective shot, focus your attention on the front of the ring circle. Because each athlete has different abilities, the influence of muscles and joints also greatly influences the movement of the jump shot.

5. Conclusion

Based on the results of the research and discussion, a conclusion can be drawn from this research, that the difference in the jump shot movement between without an opponent and with an opponent in the presence of an opponent, there is an increase in the knee angle during a jump shot with an opponent in the presence of an opponent of 10.6º, which results in an increase in height. His jump is around 5 cm when an opponent is facing him. The tilt angle of the body during a jump shot against an opponent increases to 2.4º. The position of the hand when it is in the air, the angle of the elbow when the opponent is facing it is greater at around 3.4º, while the angle of the wrist when the opponent is facing it is smaller at around 7.9º, and the height of the ball when the opponent is facing it looks higher about 8 cm. Based on this, to increase the success of jump shots, an athlete must always practice using an opponent, in order to adapt to the situation during the match and maximize the jump shot movement.

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