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The Effectiveness of Vertical Jump Take-Off Angle On Jump Height In 14-Year-Old Basketball Athletes

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ABSTRACT

Measurement tests play a very important role in identifying and developing abilities in athletes. The vertical jump test is one part of the measurement test that will be the topic of this study. This study aims to analyze the effectiveness of the push-off angle (90°, 105°, 115°) when performing the vertical jump technique on the jump height. The background of this study is based on the importance of vertical jump ability in basketball, especially for rebounding, blocking, and dunking. Although athletes have good physical condition, many of them do not know the optimal push-off angle that can maximize jump height. This study uses a descriptive quantitative method with a cross-sectional research design. The sample in this study was Castle Warrior KU-14 basketball athletes. The results of this study showed that the average jump height at a 90° angle was 57.25 cm, at a 105° angle of 58.33 cm, and at a 115° angle of 57.17 cm. The ANOVA test showed a significance value of 0.987 (> 0.05), which means that there was no statistically significant difference between the three push-off angles. However, descriptively, the 105° angle gave the highest jump results. This shows that the 105° angle tends to be more effective in producing maximum jumps.

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A. Conception and design of the study;
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INTRODUCTION

Sport is a physical activity involving bodily movement to improve fitness, skills, and health, as well as providing entertainment and enjoyment (Wisahati, Aan Sunjata, and Teguh Santosa, 2010:18). Broadly speaking, sport encompasses a wide range of activities, from recreational games to professional competitions, which can be undertaken individually or in teams. Sport plays a vital role in maintaining physical health, such as improving muscle strength, flexibility, and cardiovascular endurance, as well as aiding weight management (Saputra, S. A., 2020:1). Beyond physical benefits, sport also has a positive impact on mental health, including reducing stress, improving mood, and boosting self-confidence. Socially, sport serves as a unifying tool, strengthening

interpersonal relationships, building a spirit of cooperation, and reinforcing the values of sportsmanship and respect for opponents (Indrawan, J., & Aji, M. P., 2019:1).

According to (Gunadi, Dwi, 2018:18), sport plays a vital role in society as a means of health, entertainment, and unification for many. It is a way to maintain physical fitness and prevent disease. Furthermore, sport is also a form of entertainment, whether through direct participation or watching competitions, which sparks enthusiasm and pride, especially in supporting a favorite team or athlete (Syafruddin, M.A., Jahrir, A.S., & Yusuf, A., 2022:73-83). Socially, sport is considered capable of strengthening relationships, creating solidarity, and teaching values such as cooperation, sportsmanship, and discipline.

There are many sports that have spread widely throughout the world, and many are popular and favored by local communities. One of these is basketball. Basketball is a team sport played by two teams of five players each, intending to score points by throwing the ball into the opponent's hoop (Sampaio, J., Gonçalves, B., Mateus, N., Shaoliang, Z., & Leite, N., 2018:108-126). The sport was created in 1891 by Dr. James Naismith in Springfield, United States, as a way to keep students fit during the winter (Naismith, J., 1996:1).

According to (Sampaio, J., Gonçalves, B., Mateus, N., Shaoliang, Z., & Leite, N., 2018:108-126), basketball has many interesting aspects that make it one of the most popular sports in the world. Its fast-paced and dynamic gameplay demands speed, accuracy, and solid teamwork. Techniques such as the slam dunk, three-point shot, and crossover dribble provide a unique appeal, both for players and spectators (Trirahmawati, R., & Wismanadi, H., 2019:7). Furthermore, basketball creates dramatic moments, such as buzzer beaters or last-second comebacks, which always trigger adrenaline. This sport is also inclusive, accessible to people of all ages and genders, and provides a platform for expressing creativity and strategy. Its strong community reinforces the values of sportsmanship and friendship. Measurement tests in basketball play a crucial role in identifying and developing a player's physical, technical, and mental abilities, all of which contribute to their on-court performance (Fenanlampir, A., & Faruq, M.M., 2015:57-167). Through measurement tests, coaches can obtain objective data on various aspects necessary for basketball success, such as speed, agility, strength, endurance, and technical skills.

Vertical jump tests measure a player's jumping ability, which is crucial for rebounding and dunking, while speed tests, such as the 30-meter sprint, assess a player's acceleration ability during offensive or defensive transitions (Markovic, G., 2007:349-355). Technical aspects such as shooting accuracy, dribbling, and passing are also measured through tests to assess fundamental skills that are key to scoring points and organizing a team's offense. These measurements help coaches identify areas for improvement and design more specific training sessions tailored to the individual player's needs (Malik, A.A., & Rubiana, I., 2019:79-84).

The push-off in the vertical jump has a significant influence in the measurement tests of basketball athletes because it determines how high a player can jump, which is

very important in various aspects of the game, such as rebounding, dunking, and blocking shots (Rubiansyah, A., Rusdiana, A., & Mulyana, R. B., 2016:6-11). The power and speed of the push-off produced depend on the strength of the leg muscles, coordination, and proper technique. The stronger and more explosive the push-off, the higher the jump that can be achieved, providing a great advantage in situations of fighting for the ball in the air. The vertical jump test measures the ability of the leg muscles to produce maximum explosive power in a short time (Markovic, G., 2007:349-355). Athletes who have a strong push-off usually have an advantage in facing opponents in the air, especially in rebounding and blocking the opponent's shots. Therefore, increasing leg muscle strength through proper training can improve vertical jump performance (Clansey, A., & Lees, A., 2010:1).

Based on observations of athletes selected for the SLOMPN KU-14 competition on August 12, 2024, at the Unesa Anti-Doping Lab building, some athletes did not know how to push off during a vertical jump. Physically, all athletes were in good shape and had well-trained muscles, but they were unable to maximize their push off during a vertical jump because they lacked the proper push off position to achieve optimal height. In interviews with the athletes, most responded that they did not maximize their efforts due to having never tried the measurement test and not knowing the push-off angle that produces maximum height. This is the reason the researcher chose this research topic.

Based on the explanation above, the title of the research is "Analysis of the Effectiveness of the Push Off Angle on Jump Height in 14-Year-Old Basketball Athletes." The author selected basketball athletes from the Castle Warrior Mojokerto KU-14 Basketball Club as a sample. The author took samples from the Castle Warrior Mojokerto club because of their brilliant achievements, winning several basketball competitions and also athletes who are trained will receive scholarships to enter high school with the achievements and skills that have been trained in the club. This study was created to provide knowledge to athletes, and it is hoped that when athletes already know about vertical jumps, they can maximize their push so that they achieve better results than before. Of course, not only that, these results hope that athletes combine them with techniques in their sports so that the vertical jump measurement test can help and make athletes maximize their abilities, or even with these results can motivate athletes to train harder to maximize their push so that they can get the desired results both physically and technically.

METHODS

This study used a quantitative descriptive approach to determine the most effective takeoff angle for Castle Warrior Mojokerto KU-14 basketball athletes. This type of research was chosen because it provides a detailed and systematic overview of the research topic. The results of this quantitative descriptive study are presented numerically to determine the influence of the variables studied (Nugroho, U., 2018:2).

The research design used by the researcher to determine the research subjects was a cross-sectional study. This technique collects data at a specific point in time to

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evaluate the relationship between variables. This study did not involve repeated observations or follow-up over a specific period (Olsen, C., & St. George, D. M., 2004:26).

The population in this study were Castle Warrior Mojokerto KU-14 basketball athletes. The total sample size of the basketball club was 22 athletes. The author used a saturated sample, a sampling technique in which all members of the population are used as research samples. (Sugiyono, P. D., 2024:1). The sample used in this study was 22 Castle Warrior Mojokerto athletes.

In conducting this study, instruments were prepared to ensure the study ran smoothly. The vertical jump measurement used was a jump DF (Dynamic Jump Test). The Jump DF is a modern tool for vertical jump measurement tests.

The vertical jump height norm, according to (Baechle, T. R., & Earle, R. W. (Eds.), 2008:1), the jump height in athletes varies depending on the age, gender, and skill level of the athlete. The age criteria in performing the vertical jump also influence the results of the test (Trudeau, F., & Shephard, R. J., 2008:1-12). The following are general norms based on the vertical jump test measurement reference:

Table 1.
Vertical Jump Norms

Category	Tinggi Lompatan (cm)
Excellent	> 70 cm
Good	50 – 70 cm
Average	40 – 49 cm
Poor	30 – 39 cm
Very Poor	< 30 cm

Before conducting the vertical jump test, the athletes' height and weight were measured. A microtoise was used to measure height, while a scale was used to measure weight. Height and weight were used as supporting instruments for the data collected.

In this study, the data obtained were analyzed using descriptive and inferential statistical techniques. This analysis was conducted to determine the effectiveness of the takeoff angle in increasing jump height in 14-year-old basketball athletes at the CLS Surabaya club.

Hypothesis testing was conducted using One-Way ANOVA. One-way ANOVA is a statistical method used to compare the means of two or more groups. This test analyzes variance within and between groups to determine whether differences in group means are significant or simply due to random variation. (St, L., & Wold, S., 1989:1)

RESULTS AND DISCUSSION

Result

The subjects of this study were athletes from the Castle Warrior Club KU-14, located at SMA 1 Puri Mojokerto. Based on the athlete data collected, there are 22 male athletes from the Castle Warrior Club, as well as athletes obtained through a survey. The author used a saturated sample, namely, all male athletes from the Castle Warrior Club. The author will present the results of the conducted tests, which were structured as follows: height, weight, and vertical jump tests at angles of 90°, 105°, and 115°.

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This data shows the characteristics of the sample based on weight, height, and jump height of the Castle Warrior basketball athletes.

Table 2.
Sample Characteristics

Characteristics	M±SD
Weight	55±14.29
Height	168±6.02
90° angle jump height	57.6±7.26
105° angle jump height	60,4±6.32
115° angle jump height	56,6±7.86

Based on this study, the sample results in Table 4.1 show that the average sample weight was 55±14.29, the average sample height was 168±6.02, the sample jump height at a 90° takeoff angle was 57.6±7.26, the sample jump height at a 105° takeoff angle was 60.4±6.32, and the sample jump height at a 115° takeoff angle was 56.6±7.86. Based on the data above, the 105° angle showed the highest average result compared to the 90° and 115° angles.

Using the IBM SPSS Statistics Subscription application, the results of the Shapiro-Wilk normality test produced the following output:

Table 3.
Normality Test

Angle of Repulsion	statistic	df	Sig.
90°	.963	22	.547
105°	.964	22	.578
115°	.930	22	.125

(Hanusz, Z., Tarasinska, J., & Zielinski, W., 2016)

From the output results above, it can be identified that the degrees of freedom (df) for the sample is 22 athletes. This figure indicates that the number of data samples in both groups is below 50. Therefore, the application of the Shapiro-Wilk test in the test is considered appropriate and correct.

From the data listed in the test results above, the Sig. The value for the 90° group is 0.547. Meanwhile, the Sig. The value for the 105° group is 0.578. Meanwhile, the Sig. The value for the 115° group is 0.125. Because the Sig. Values for these three groups are >0.05; it can be concluded that the test results are normally distributed and will be further tested using One-Way ANOVA.

Table 4.
Homogeneity Test

Levane statistic	df1	df2	Sig.
.348	2	63	.708
.269	2	63	.765
.269	2	63	.765
.309	2	63	.735

Table 4 shows that the Sig. The value in the homogeneity test above is >0.05, indicating that the data variance is homogeneous. In other words, the assumption of the homogeneity test has been met for the next test.

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Table 5.
One-Way ANOVA Test

Skor	Sum of squares	df	Mean squares	f	Sig.
Between Groups	1.303	2	.625	.013	.987
Within groups	3246.955	63	51.539		
Total	3248.258	65			

The decision-making process, as shown in Table 5, shows that the ANOVA test's Sig. Value is 0.987. The Sig. value is >0.05, indicating that there are differences between the three groups, but the differences are small.

Table 6.
Post-hoc Test

Group	Mix	Mean Difference	Std.	Sig.	Lower Bound	Upper Bound
Group 1	Group 2	-.27273	2.16457	1.000	-5.5967	5.0512
	Group 3	-.31818	2.16457	1.000	-5.6421	5.0058
Group 2	Group 1	.27273	2.16457	1.000	-5.0512	5.5967
	Group 3	-.04545	2.16457	1.000	-5.3694	5.2785
Group 3	Group 1	.31818	2.16457	1.000	-5.0058	5.6421
	Group 2	.04545	2.16457	1.000	-5.2785	5.3694

Decision making according to table 6, from the table shows that the Sig. The value of the post hoc test is 1,000. From the table value above, the Sig. The value is 1,000, which means the difference value is relatively slightly significant.

Discussion

Based on the results of a study on the effectiveness of vertical jump takeoff angle on jump height in 14-year-old basketball players at the Castle Warrior Club in Mojokerto, it can be concluded that takeoff angle influences jump results, although not statistically significantly. This study used three takeoff angles: 90°, 105°, and 115°, to determine which angle was most effective in producing maximum jump height. Data analysis showed that the average jump height at the 105° angle was the highest (60.4 cm), compared to the 90° angle (57.6 cm) and the 115° angle (56.6 cm).

Although the ANOVA test showed a significance value of 0.987 (>0.05), indicating no significant difference between the takeoff angle groups, descriptively, the 105° angle has the most optimal potential for producing the highest jump. This confirms findings from previous research, which stated that the ideal takeoff angle in a vertical jump ranges from 100°–110°, where the balance between vertical force and momentum is maximized (Budiman, 2012:1). This angle allows the body to optimally perform triple extension, which involves simultaneous extension of the hip, knee, and ankle joints, resulting in greater upward propulsion.

A 90° angle, which is a takeoff angle with sharper knee flexion, tends to place excessive stress on the joints and cause a loss of potential energy during the takeoff phase. This may explain why jumps at this angle are not as high as those at 105°, although for some athletes with strong quadriceps and hamstring strength, this angle can still produce quite high jumps. Meanwhile, an angle of 115° tends to produce a lower jump, possibly because the body is in a position that is too open when pushing off, so that the

vertical force generated is not optimal and some of the energy is channelled in a horizontal direction (Yusuf, F. I., & Rubiono, G., 2018:1-2).

These results are supported by research by Primorezta, R. (2014:2), which states that a 105° knee angle during the jump start produces the highest jump height in vertical jump testing. This study also used a biomechanical approach and Dartfish software, which visually demonstrated that a 105° angle produces optimal leg muscle propulsion.

Furthermore, research by Clansey & Lees (2010:1) also demonstrated a strong curvilinear relationship between knee and hip flexion and jump height. Their study found that when the knee flexion angle was between 100° and 110°, there was a linear increase in hip flexibility and vertical propulsion, and showed that the highest jump height occurred within this angle range. This reinforces the findings of this study that a 105° angle has a biomechanical advantage in producing higher jumps.

Another study by Budiman, A. F. (2012:1) showed that although a 90° angle had the highest leg power values, this angle was not always effective in producing the best jump height. This is because an angle that is too small causes the dominant force direction to be horizontal, rather than vertical, thus decreasing jump efficiency. In the context of this study, although some athletes performed quite well at a 90° angle, this is likely related to individual characteristics such as quadriceps strength and personal takeoff technique.

In addition to angle, success in vertical jumps is also influenced by execution technique, muscle strength, flexibility, and the athlete's experience. Observations show that most athletes are unfamiliar with the concept of push-off biomechanics and have never performed similar measurements. However, after being given guidance and explanations by researchers, athletes were able to understand and adapt to a more optimal push-off angle, particularly 105°, when performing vertical jumps (Markovic, G., 2007:349-355).

Coaches are advised to provide vertical jump technique training with a focus on optimal knee angle position, particularly in the 100°–110° range. The results of this study indicate that many athletes are unaware of the optimal push-off angle. Therefore, it is important to provide education through a light theoretical session before or after training, with a brief explanation of how the takeoff angle affects their jump results. Due to the differences in physical characteristics of each athlete (muscle strength, joint flexibility, experience), coaches are advised to provide more personalised training, particularly in terms of leg muscle explosiveness, knee and hip flexibility, and posture correction (Yusuf, F. I., & Rubiono, G., 2018:40-44).

Thus, this study aligns with previous research and reinforces the importance of a biomechanical approach in physical training, particularly in developing vertical jump technique in basketball. It is hoped that these findings can serve as a basis for coaches in developing more effective, data-driven training programs.

CONCLUSION

Based on the presentation in Chapter IV, which contains the research results and data analysis, it can be concluded that a takeoff angle of 105° is the most effective angle

for producing the highest vertical jump for Castle Warrior basketball athletes in the 14-year-old age group.

In addition to the angle factor, vertical jump success is also influenced by execution technique, muscle strength, flexibility, and the athlete's experience. Observations showed that most athletes were unfamiliar with the concept of takeoff biomechanics and had never conducted similar measurements. However, after being given guidance and explanations by the researcher, the athletes were able to understand and adapt to a more optimal takeoff angle.

REFERENCES

Abrar, I. I., & Fitroni, H. (2021). Pembinaan cabang olahraga bola basket pada usia dibawah 20 tahun di Jawa Timur. Jurnal Kesehatan Olahraga, 9(4), 145–154.

Aris, T., & Mu'arifuddin, M. A. (2020). Pengembangan buku ajar bola basket untuk mahasiswa. Jendela Olahraga, 5(2), 62–69.

Baechle, T. R., & Earle, R. W. (Eds.). (2008). Essentials of strength training and conditioning. human kinetics, 1

Budiman, A. F. (2012). Perbedaan Sudut Tolakan Terhadap Nilai power Tungkai. Medikora, 13(1), 1

Budiwanto, S. (2017). Metode Statistika: Untuk Mengolah Data Keolahragaan. Metode Statistika, 1–233.

Clansey, A., & Lees, A. (2010). Changes in lower limb joint range of motion on countermovement vertical jumping. In ISBS-Conference Proceedings Archive.1

Daharis, D., Gazali, N., & Candra, O. (2022). Biomekanika Olahraga.1

Fenanlampir, A., & Faruq, M. M. (2015). Tes dan pengukuran dalam olahraga. Penerbit Andi.57-167

Gunadi, Dwi. (2018). Peran Olahraga Dan Pendidikan Jasmani Dalam Pembentukan Karakter. Jurnal Ilmiah Spirit, 18(3).

Hanusz, Z., Tarasinska, J., & Zielinski, W. (2016). Shapiro–Wilk test with known mean. REVSTAT-statistical Journal, 14(1), 89-100.

Indrawan, J., & Aji, M. P. (2019). Olahraga sebagai Sarana Pemersatu Bangsa dan Upaya Perdamaian Dunia. Jurnal Ilmiah Hubungan Internasional.1

Kiswah, K., Hidayatullah, F., Widodo, H. M., & Himawan, A. (2024). Analisis Biomekanika Terhadap Gerak Lay-Up Mahasiswa Olahraga STKIP PGRI Bangkalan 2022 Menggunakan Aplikasi Kinovea. iyadhoh: Jurnal Pendidikan Olahraga, 7(1), 108–114.

Malik, A. A., & Rubiana, I. (2019). Kemampuan Teknik Dasar Bola Basket: Studi Deskriptif Pada Mahasiswa. Journal of SPORT (Sport, Physical Education, Organization, Recreation, and Training), 3(2), 79–84.

Markovic, G. (2007). Does plyometric training improve vertical jump height? A meta-analytical review. British journal of sports medicine, 349–355.

Naismith, J. (1996). Basketball: Its origin and development. U of Nebraska Press.1

Nugroho, U. (2018). Metodologi penelitian kuantitatif pendidikan jasmani. Penerbit CV. Sarnu Untung.2

Olsen, C., & St George, D. M. (2004). Cross-sectional study design and data analysis. College entrance examination board, 26(03).

Primorezta, R. (2014). Efektifitas Sudut Sendi Lutut Terhadap Kemampuan Daya Ledak Otot Tungkai untuk Tes Vertical Jump. Jurnal Kesehatan Olahraga, 2(3).

Refiater, U. H. (2012). Hubungan Power Tungkai Dengan Hasil Lompat Tinggi. Journal of Health and Sport, 5(03).

Ridha, N. (2017). Proses penelitian, masalah, variabel dan paradigma penelitian. Hikmah. Hikmah, 14(1), 62-70.

Rubiansyah, A., Rusdiana, A., & Mulyana, R. B. (2016). Pengaruh latihan plyometrics terhadap hasil tolakan start pada olahraga renang. Jurnal Terapan Ilmu Keolahragaan, 1(1), 6–11.

Sampaio, J., Gonçalves, B., Mateus, N., Shaoliang, Z., & Leite, N. (2018). Basketball. In Modelling and simulation in sport and exercise, 108–126.

Saputra, S. A. (2020). Menjaga imunitas dan kesehatan tubuh melalui olahraga yang efektif.

Prosiding Seminar Nasional Pendidikan STKIP Kusuma Negara III.1

St L., & Wold, S. (1989). Analysis of variance (ANOVA). Chemometrics and intelligent laboratory systems, 6(4), 259-272.

Sugiyono, P. D. (2024). Buku ajar metodologi penelitian.1-3

Syafruddin, M. A., Jahrir, A. S., & Yusuf, A. (2022). Peran pendidikan jasmani dan olahraga dalam pembentukan karakter bangsa. urnal Ilmiah STOK Bina Guna Medan, 10(2), 73– 83.

Trirahmawati, R., & Wismanadi, H. (2019). PERFORMA DASAR BERMAIN BOLABASKET PADA TIM BOLABASKET PUTRA SMA NEGERI 6 SURABAYA. Jurnal Kesehatan Olahraga, 7(2).

Trudeau, F., & Shephard, R. J. (2008). Physical education, school physical activity, school sports and academic performance. International journal of behavioral nutrition and physical activity, 5, 1–12.

Wisahati, Aan Sunjata, and Teguh Santosa. (2010). Pendidikan jasmani olahraga dan kesehatan. Pusat Perbukuan Kementrian Pendidikan.18

Yusfi, H., & Solahuddin, S. (2020). Teknik pembelajaran keterampilan dasar passing bola basket. Bening Media Publishing 1

Yusuf, F. I., & Rubiono, G. (2018). Analisis Matematis Prediksi Jarak Lompatan Atlet Lompat Jauh Berbasis Sudut Tolakan (Take-off). In Prosiding Seminar Nasional IPTEK Olahraga (SENALOG), 40–44.