THE RELATIONSHIP BETWEEN BIOMOTOR COMPONENTS AND SOCCER PLAYER'S SHOOTING SKILL: A META-ANALYSIS STUDY

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ABSTRAK : Dalam sepakbola, terdapat penelitian yang mengkaji komponen biomotor serta keterampilan menembak (shooting). Berbagai penelitian tersebut memperjelas bahwa komponen biomotor memiliki efek yang sangat positif dalam meningkatkan shooting dalam sepak bola. Namun hasil dari setiap penelitian cenderung bervariasi, sehingga diperlukan analisis data yang luas untuk mendapatkan informasi yang komprehensif tentang pentingnya komponen biomotor dalam meningkatkan kemampuan menembak. Penelitian ini menyelidiki pengujian *effect size* (ES) dari komponen biomotor terhadap kemampuan *shooting* sepak bola. Jenis penelitian yang digunakan yaitu studi meta-analisis. *Google Scholar* menjadi sumber database yang digunakan untuk mencari sumber data. Pencarian literatur dari berbagai sumber menggunakan kata kunci: "*power*" *AND* "ketepatan" *AND* "reaksi" *AND* "keseimbangan" *AND* "daya ledak" *AND* "kelincahan" *AND* "koordinasi" *AND* "*shooting* sepak bola" diperoleh 230 artikel yang kemudian di filter berdasarkan kriteria inklusi dan eksklusi diperoleh 11 artikel yang dianalisis. Analisis data dilakukan melalui beberapa tahapan mulai mengidentifikasi variabel sampai menghitung nilai *summary effect* (SE). Meta analisis dilakukan dengan *Jeffreys Amazing Statistics Program* (JASP). Hasil analisis dengan menggunakan model *random effect* menunjukkan bahwa terdapat hubungan positif yang signifikan antara komponen biomotor dengan keterampilan shooting pemain sepak bola (z = 6.018, p<0.001, 95%CI, (0.484; 0.951), antara komponen biomotor dengan keterampilan menembak pemain sepak bola termasuk dalam kategori tinggi (rRE=0,717). Hasil studi dapat disimpulkan bahwa komponen biomotor memiliki hubungan yang positif dengan kemampuan *shooting* pemain sepakbola.

KATA KUNCI :　　　　Komponen Biomotor; Shooting; Sepakbola; Meta Analisis.

ABSTRACTS : Studies that examine biomotor components and also shooting ability have been carried out in the field of sports. The various studies explain that biomotor components have a positive effect on improving shooting ability in soccer. However, the results of each study tend to vary, so it is necessary to analyze the data inclusively to provide comprehensive information about the importance of the biomotor component in improving athletes' shooting ability. This study examines the effect of size testing of biomotor components on the shooting ability of soccer players. The type of research used is a meta-analysis study. The data source in this study is Google Scholar. Literature searches from various sources using keywords: "power" AND "accuracy" AND "reaction" AND "balance" AND "explosive power" AND "agility" AND "coordination" AND "soccer shooting" obtained 230 articles which were then filtered based on the inclusion and exclusion criteria obtained 11 articles analyzed. Data analysis was carried out through several stages from identifying variables to calculating the summary effect (SE) value. Meta-analysis was conducted with Jeffreys's Amazing Statistics Program (JASP) software. The results of the analysis using the

random effect model show that there is a significant positive relationship between the biomotor component and the shooting skills of soccer players (z = 6.018, p <0.001, 95%CI, (0.484; 0.951), between the biomotor component and the shooting skills of soccer players included in the high category (rRE = 0.717). The study results can be concluded that the biomotor component has a positive relationship with the shooting ability of soccer players.

KEYWORD :   **Biomotor Component; Shooting; Football; Meta Analysis.**

1. INTRODUCTION

Soccer is a physical activity that is very popular in the society, both adults, teenagers, and children. In addition to have an impact on health improving or increasing body immunity, soccer may also provide entertainment for the society. According to Riansyah (2019) shooting is one of the basic techniques in a soccer game, which is done using the back of the foot where the direction of the kick is towards the opponent's goal so that a goal can be scored to win the match. It is very important for a soccer athlete, especially a player who is in the attacking sector, to practice shooting towards the goal in order to maximize the opportunities available to score goals.

In maximizing shooting skill, increasing the biomotor component is one of the appropriate supporting factors. In the shooting skill of a soccer player, the biomotor ability can not be separated, for the better a person's biomotor ability, the better the shooting quality of a soccer player. So, to maximize the shooting skill of soccer players, we need to improve or train the factors that influence the shooting skill.

In conducting shooting activities in soccer games, there are several effects of biomotor components, they are power, accuracy, reaction, balance, explosive power, agility, coordination. Speaking of accuracy, there are several stages in shooting, including placing the foot position right next to the ball, which is used as a pedestal and also the impact between the foot and the ball must be right so that the flow and also the goal of the ball are as expected (Rizki, 2021). Zuhri (2021) said that one thing that must be considered in the process of kicking a ball is ankle coordination. Meanwhile, power is one of the biomotor components in sports activities, because power will determine how hard people hit or kick (Zuhri, 2021). Zuhri's research (2021) also said that strength is an ability that is closely related to the process of muscle contraction. So, it is very influential for an athlete when kicking. Regarding balance and agility, Zawawi (2016) stated that if an athlete has good agility and balance, then the level of balance will be good too. This is related to the coordination that is directly related to the process of kicking the ball.

Studies that examine the biomotor component and the shooting skill of soccer players have been widely carried out in the field of sports. These kinds of studies explained that the biomotor component has a very positive effect on improving shooting skills in soccer (Pratama, Sugiyanto, & Kristiyanto, 2018; Marta & Oktarifaldi, 2020; Adityatama, 2017). To provide comprehensive information about the significance of the biomotor component in shooting in soccer games, a comprehensive data analysis must be conducted because the findings of each research frequently differ. Based on this explanation, it is important to investigate whether biomotor components have a relationship with the shooting ability of soccer athletes through a meta-analysis study.

Research on meta-analysis in football has been carried out, some of which analyze the epidemiology of injuries in professional football (López-Valenciano et al., 2020), the impact of heading on football (Kontos, et al., 2017), and psychological factors and player performance future football (Ivarsson et al., 2020). However, studies that have analyzed the relationship between the biomotor component and shooting ability in soccer have never been carried out, so this study seeks to analyze studies on the

relationship between the biomotor component and shooting ability in soccer using a meta-analysis approach.

2. METHOD

This research is quantitative descriptive. The type of this research used in this article was meta-analysis. Meta-analysis is research carried out to summarize data, review data and also analyze existing research data or previous research (Anugraheni, 2018). Meta-analysis is very necessary in research to assess a study whose truth is still unclear from the data obtained (Balduzzi et al., 2019). This study aimed to examine the effect size of the biomotor component on shooting skill through a meta-analysis study. Meta-analysis is very useful, especially for education circles, one of which is a sports teacher who wants to improve shooting skills through the ability of the athlete's biomotor component. The steps in conducting meta-analysis of data were (1) Determining and studying the relationship between the studies to be studied, (2) Collecting case studies in the form of research results that have been carried out according to keywords, (3) Calculation of effect size, (4) Finding heterogeneity of effect size, (5) Interpretation of research data and conclusions (Decoster & Hall, 2004).

Full-text documents published at the national level were used as data sources. This research was conducted on March 16, 2022. The data searching was using the Google Scholar database using the keywords "power" AND "precision" AND "reaction" AND "balance" AND "explosive power" AND "agility" AND "coordination" AND "soccer shooting".

From this study, 11 populations of article data were obtained from various sources. The purposive sampling technique was used to determine the sample involved. The criteria used by researchers in taking data samples here utilized inclusion and exclusion criteria. The data used in this study were .

Inclusion Criteria:

1. The articles published in 2015 to 2019.
2. The article sourced from Google Scholar.
3. The article discusses the biomotor components that affect soccer shooting skill.
4. Documents published in national journals, not repository documents and proceedings.
5. The article uses a quantitative research design, especially the one that uses the t-test and f-test in the research data.
6. The articles must be in the form of full text that can be accessed.
7. The research was conducted in Indonesia.

Exclusion Criteria

1. Research that does not examine the biomotor component and shooting ability in football falls under the category of research with different operational meanings.

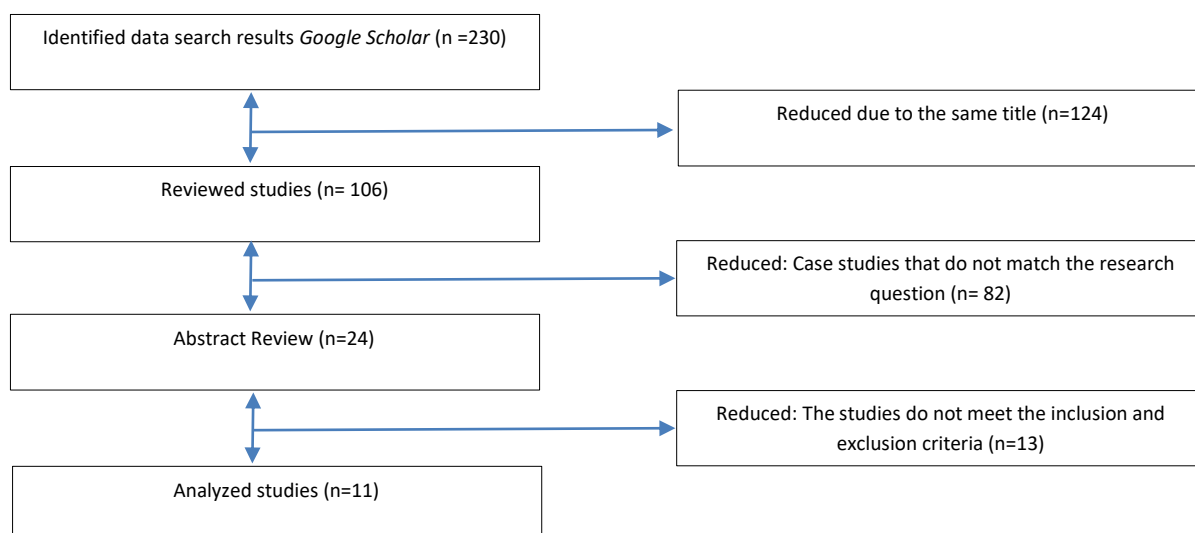**Tito Rivaldi[1], Imam Hariadi[2], Yulingga Nanda Hanief[3*]**

Figure 1 Flowchart in identifying the case study data that are eligible for meta-analysis.

The next step is to 1) identify the research variables, 2) identify the r value in the article to be analyzed. If the document only reports the F or t value, it needs to be transformed to the r value with the equation:

1. $F = t^2$
2. $t = \sqrt{F}$
3. $r = \dfrac{t}{\sqrt{t^2 + N - 2}}$

The next step are 3) converting the r value into a z distribution and calculating the variance, 4) finding the standard error (SE) of z, and 5) determining the summary effect (SE). Summary effect is sought with the help of JASP.

3. RESULT

Based on the keywords that had been entered on the Google Scholar, there were found as many as 230 articles discussing the biomotor component and soccer shooting. Furthermore, screening based on inclusion and exclusion criteria, 11 articles that could be analyzed were found. The studies to be analyzed are presented in table 1 below.

Table 1. Data Study to be Conducted Meta-Analysis

Authors/Year	Sample Characteristics	N	Measurement Variable	R
(Mustakim, 2016)	Elementary School Students	50	Power, speed and shooting	0,254
(Alqadri et al., 2017)	Senior High School Students	26	Balance and shooting	0,634
(Dedi Saputra & Juita, 2016)	SSB Players	20	Power, speed and shooting	0,891
(Diwa et al., 2016)	Soccer Players	20	Coordination and shooting	0,754
(Azmi Pratama & Vai, 2017)	SSB Players	18	Power, Coordination and shooting	0,589
(Adityatama, 2017)	SSB Players	30	Power, Coordination, power and shooting	0,338
(Sulaeman et al., 2019)	Senior High School Students	40	Flexibility, balance, coordination and shooting	0,869
(Trisnadi, 2019)	Senior High School Students	25	Flexibility, agility and shooting	0,531
(Anis Zawawi, 2016)	SSB Players	30	Power, coordination, balance and shooting	0,313
(Rahman Wahid et al.,	Senior High School Students	18	Power, coordination and	0,706

| 2017) | | | shooting | |
| (Riansyah, 2019) | College Students | 20 | Power and shooting | 0,641 |

Heterogeneity Test Results

The goal of the heterogeneity test was to identify any variance disparity from the residual or whether there was a difference between the observed value and the predicted value for all observations in the regression model which would later get a relationship between a dependent variable and an independent variable.

Table 2. Fixed and Random effects

	Q	df	p
Omnibus test of Model Coefficients	36.216	1	< .001
Test of Residual Heterogeneity	36.956	10	< .001

Note. p -values are approximate.
Note. The model was estimated using Restricted ML method.

The results of the analysis showed that the effect sizes of the 11 analyzed studies were heterogeneous (Q = 36.956, p < 0.001). Therefore, it was more appropriate to determine the mean effect size of the 11 analyzed studies using the random effect model. The analysis's findings also suggested that it might be possible to look into moderating factors that affected the connection between soccer players' biomotor components and their aiming prowess.

Results of Summary effect/Mean Effect size

To determine a summary or general description of the expected impact size, the "summary effect" was calculated (Retnawati et al., 2018). Based on the random effect correlation value, the summary effect test in this research was used to determine the degree of correlation between the biomotor component and the shooting ability of soccer players.

Table 3. Coefficients

	Estimate	Standard Error	z	p	95% Confidence Interval	
					Lower	Upper
intercept	0.717	0.119	6.018	< .001	0.484	0.951

Note. Wald test.

The results of the analysis using the random effects model showed that there was a significant positive correlation between the biomotor component and the shooting skill of soccer players (z = 6.018, p<0.001, 95%CI, (0.484; 0.951). The influence between the biomotor component and the shooting skill of soccer players was included in the high category (rRE=0,717).

* r = 0,1(low); r = 0,3(medium); r = 0,5(high) (Cohen, 1992).

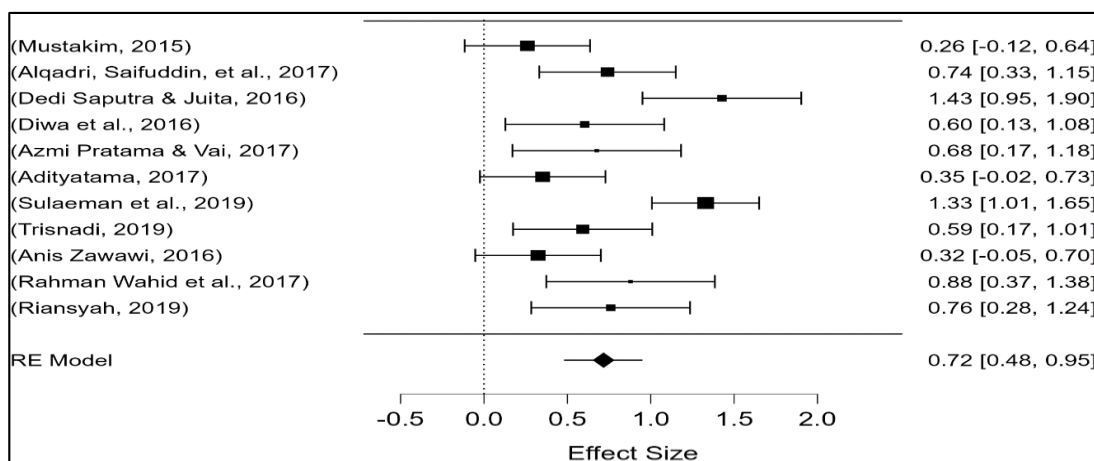Tito Rivaldi[1], Imam Hariadi[2], Yulingga Nanda Hanief[3*]

Figure 2. Forest Plot

Based on the Forest Plot above, it can be seen that the effect size of the analyzed studies varies between 0.26 and 1.43. From the Forest Plot table above, the Restricted Model (RE Model) value is 0.72, which means that the average biomotor component is significantly related to the shooting skill of soccer players by 72%, and it is in the strong category, with 31% being influenced by other variable factors.

Publication Bias Analysis

To ascertain whether there was bias in each of the examined papers, a publication bias analysis was carried out. The purpose of the publication bias test was to determine whether the data to be studied in this study was valid or manipulated.
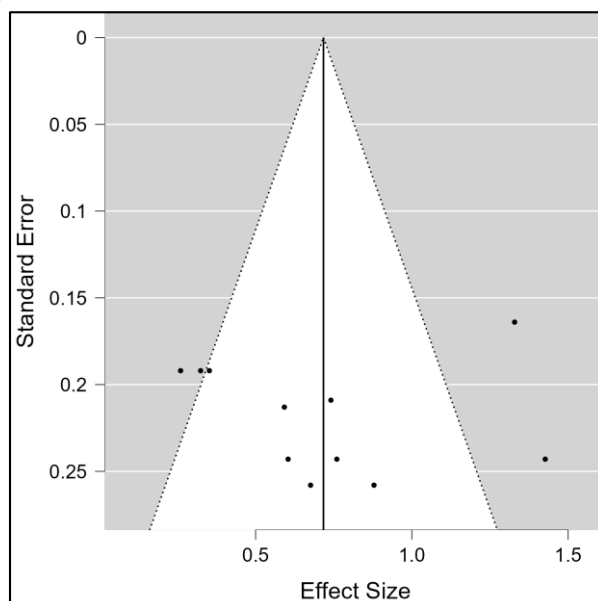

Figure 3. Funnel Plot

Due to the difficulty in determining whether the funnel plot is symmetrical or not from the findings of the aforementioned funnel plot analysis, an egger's test was required.

Table 4. Regression Test for Funnel Plot Asymmetry (Egger's Test)

Regression test for Funnel plot asymmetry ("Egger's test")		
	Z	P
Sei	0.380	0.704

When the funnel diagram does not show a symmetrical pattern, Egger's test is applied. If the p value is higher or less than the 95% significant value, it can be seen if the funnel plot is symmetrical or not. (0.05). If the p value exceeds the significant value, either there is no publishing bias issue or the funnel plot exhibits a symmetrical pattern.

Based on the results of Egger's test above, the p value > 0.05 informs that the funnel plot value is symmetrical. Thus, it can be concluded that there is no publication bias in this meta-analysis study.

Table 5. File drawer Analysis

	Fail-safe N	Target Significance	Observed Significance
Rosenthal	490.000	0.050	< .001

File drawer analysis is an estimate of the number of articles whose results are not significant and are not published (Rosenthal, 1979). File drawer analysis showed that K=11, so 5K+10 = 5(11) + 10 = 65 . The value of fail-safe N obtained was 490.000, with a significant target of 0.050 and p> 0.001. Because the value of fail-safe was N > 5K + 10 , it can be concluded that there was no problem of publication bias in the meta-analysis study..

4. DISCUSSION

Many factors affect the shooting skill of soccer players. Shooting is one of the basic techniques in soccer that is used with the aim of scoring a goal against the opponent's goal to achieve a victory in a match. One aspect that affects the shooting skill of soccer players is the quality of the player's biomotor. Biomotor is the movement in humans that is influenced by other systems that exist within the human being (Anzari, 2019). Anugrah (2019) said that biomotor is the movement of athletes that is stimulated by internal organ systems, including joints, bones, energy systems, blood circulation, respiration, and neuromuscular. From the opinions above, it can be concluded that a biomotor is the movement of parts of the human body that are influenced by internal organ systems. There are several biomotor components that affect the shooting skill of soccer players including: power, accuracy, reaction, balance, explosive power, agility, coordination.

Speaking of accuracy of shooting, there are several stages including placing the foot position right next to the ball which is used as a pedestal and also the impact between the foot and the ball must be right so that the flow and also the goal of the ball are as expected (Rizki, 2021). Zuhri (2021) said that one thing that must be considered in the process of kicking a ball is ankle coordination. Meanwhile, power is one of the biomotor components in sports activities, because power will determine how hard people hit or kick (Zuhri, 2021). Zuhri's research (2021) also said that strength is an ability that is closely related to the process of muscle contraction, so it is very influential for an athlete when doing a kick. Regarding balance and agility, Zawawi (2016) stated that if an athlete has good agility and balance, then the level of balance will be good too, and this is related to the coordination that is directly related to the process of shooting the ball.

From the results of the analysis above, it can be seen that there is a positive and significant relationship between the biomotor component and the shooting skill of soccer players, with a random effect correlation value. (rRE) 0.717, it can be concluded that these two variables have a relationship with the high category. So, the higher the ability of the biomotor component of an athlete, the better the

shooting skill. The results of this study also strengthen the idea of previous research, that there is a simultaneous significant relationship between explosive power of leg muscles and ankle coordination on accuracy shooting results (Wahid et al., 2017). Simultaneously, there is a significant relationship between leg muscle strength and ankle coordination with soccer shooting skill (Zuhri, 2021).

Although the results of the publication bias analysis in the funnel plot diagram cannot be shown clearly and specifically, the egger test and fail safe N analysis showed that there was no publication bias. This showed that the meta-analysis of the data conducted on the relationship between the biomotor component and the shooting skill of soccer players can be accepted as unambiguous data and according to the current conditions.

The weakness in this research is that the subject search only came from Google Scholar. And the articles reviewed were only articles that the researches were conducted in Indonesia. The explanation above can be used as a source of reference for future researchers so that they can create new research that is more creative and innovative about the relationship between biomotor components and the shooting skill of soccer players.

5. CONCLUSION

Marked by the correlation value of Random effect, which was included in the high category, therefore it can be concluded that there was no bias in data publication and there was a significant positive correlation between the biomotor component and the shooting skill of soccer players.

Based on the discussion above, the suggestions or recommendations are as follows. It is recommended to the future researchers to be able to expand the range of years in the article searching to be reviewed and not only sourced from a media (Google Scholar), but also look for articles from many other sources. And it is recommended for further researchers to be able to look for articles not only published or made in Indonesia. Based on the findings, it is also suggested to coaches to consider aspects of the biomotor component in recruiting and improving the performance of football athletes. For the general public, these findings serve as a reference for them that one of the achievements can be achieved by increasing the biomotor components.

REFERENCES

Adityatama, F. (2017). Hubungan Power Otot Tungkai, Koordinasi Mata Kaki Dan Kekuatan Otot Perut Dengan Ketepatan Menembak Bola. JUARA: Jurnal Olahraga, 2(2), 82-92. https://doi.org/10.33222/juara.v2i2.37

Alqadri, Saifuddin, & Abdurrahman. (2017). Hubungam Kesimbangan Dengan Shooting Dalam Permainan Sepak bola (Pada Siswa Sma Negeri 1 Rundeng Kota Subulussalam Tahun 2016). Jurnal Ilmiah Mahasiswa Pendidikan Jasmani, Kesehatan Dan Rekreasi Fakultas Keguruan Dan Ilmu Pendidikan Unsyiah; 3(3), 225-233.

Anugrah. (2019). Perbedaan Pengaruh Komponen Biomotor Ditinjau Dari Golongan Darah Atlet Bola Voli Sma Negeri 26 Kab. Bone. (Doctoral dissertation, Universitas Negeri Makassar).

Anugraheni, I. (2018). Meta Analisis Model Pembelajaran Problem Based Learning Dalam Meningkatkan Keterampilan Berpikir Kritis Di Sekolah Dasar. Polyglot, 14(1), 9–18.

Balduzzi, S., Rücker, G., & Schwarzer, G. (2019). How To Perform a Meta-Analysis With R: A Practical Tutorial. Evidence-Based Mental Health, 22(4), 153–160. https://doi.org/10.1136/Ebmental-2019-300117

Cohen, J. (1992). Current Directions in Psychological Science. Sage Journal, 1, 98. Https://Doi.Org/10.1111/1467-8721.Ep10768783

Decoster, J., & Hall, G. P. (2004). Meta-Analysis Notes. Narrative.

Diwa, Bustaman, & Saifuddin. (2016). Hubungan Koordinasi Mata-Kaki Dengan Kemampuan Shooting Dalam Permainan Sepak bola Pada Klub Sepak bola Himadirga Tahun 2013. In Ilmu Pendidikan Unsyiah, 2(3), 235-244. http://www.jim.unsyiah.ac.id/penjaskesrek/article/view/524

Gilang Anzari, J. (2019). Tingkat Biomotor Dan Antropometri Atlet Bola voli Pantai Putra Jawa Timur. Jurnal Prestasi Olahraga, 1(1).

Ivarsson, A., Kilhage-Persson, A., Martindale, R., Priestley, D., Huijgen, B., Ardern, C., & McCall, A. (2020). Psychological factors and future performance of football players: A systematic review with meta-analysis. Journal of science and medicine in sport, 23(4), 415-420.

Kontos, A. P., Braithwaite, R., Chrisman, S. P., McAllister-Deitrick, J., Symington, L., Reeves, V. L., & Collins, M. W. (2017). Systematic review and meta-analysis of the effects of football heading. British journal of sports medicine, 51(15), 1118-1124.

López-Valenciano, A., Ruiz-Pérez, I., Garcia-Gómez, A., Vera-Garcia, F. J., Croix, M. D. S., Myer, G. D., & Ayala, F. (2020). Epidemiology of injuries in professional football: a systematic review and meta-analysis. British journal of sports medicine, 54(12), 711-718.

Marta, I. A., & Oktarifaldi, O. (2020). Koordinasi Mata-Kaki dan Kelincahan terhadap Kemampuan Dribbling Sepakbola. Gelanggang Olahraga: Jurnal Pendidikan Jasmani Dan Olahraga, 4(1), 1-14.

Nuraini, D. A., Nafan, A., Muhlis, A., Airlangga, U., & Java, E. (2021). The Correlation Between Husband Support and The Use of Intra- Uterine Device (IUD) In Women of Childbearing Age: A Meta-. 10(July), 68–75. Https://Doi.Org/10.20473/Jbk.V10i1.2021.68

Pratama, A, A., & Vai, A. (2017). Contribution Explosive Power Limb Muscles and Coordination Eyes And Feet With Accuracy Shooting School Soccer Patriot Muda Kuok. (Doctoral dissertation, Riau University).

Pratama, A. P., Sugiyanto, S., & Kristiyanto, A. (2018). Sumbangan Koordinasi Mata-Kaki, Kelincahan, Keseimbangan Dinamis dan Fleksibilitas Togok Terhadap Kemampuan Menggiring Bola pada Permainan Sepakbola. Jurnal SPORTIF: Jurnal Penelitian Pembelajaran, 4(1), 15-27.

Retnawati H., Apino E., Kartianom, Djidu H., & Anazifa R. D. (2018). Pengantar Analisis Meta.

Riansyah, A. (2019). Kontribusi Power Otot Tungkai Terhadap Hasil Shooting Ke Gawang Mahasiswa Putera Kelas 2/A Angkatan 2018 Penjaskesrek Fkip Universitas Islam Riau.

Rizki. (2021). Variasi Teknik Shooting Sepak Bola dan Cara Melakukannya. Diambil kembali dari PastiGuna.com: https://pastiguna.com/teknik-dasar-sepak-bola/shooting/

Rosenthal, R. (1979). The file drawer problem and tolerance for null results. Psychological bulletin, 86(3), 638.

Saputra, D, W., & Juita, A. (2016). Hubungan Kekuatan Otot Tungkai Dan Kecepatan Terhadap Kemampuan Shooting Dalam Permainan Sepak bola Pada Ssb Universitas Riau U-15. (Doctoral dissertation, Riau University).

Saputra R. (2019). Kontribusi Koordinasi Mata-Kaki Dan Daya Ledak Otot Tungkai Terhadap Ketepatan Shooting sepakbola Pada siswa Ssb Setia Darma Kabupaten Bengkalis. (Doctoral dissertation, Universitas Islam Riau).

Sulaeman, S., Rahman, A., & Mappanyukki, A. A. (2019). Analisis Kelentukan, Keseimbangan Dan Koordinasi Mata Kaki Terhadap Ketepatan Tendangan Pada Permainan Sepakbola. SPORTIVE: Journal of Physical Education, Sport and Recreation, 3(1), 70-74.

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Trisnadi, J. R. (2019). Hubungan Kelentukan, Kelincahan, Konsentrasi Dengan Ketepatan Menendang Bola Dalam Permainan Sepak bola Ekstrakurikuler Sman 1 Ngunut.

Wahid, R, A., Juita, A., & Mpd, Sp. (2017). Hubungan Explosive Power Otot Tungkai Dan Koordinasi Mata-Kaki Dengan Accuracy Shooting Pada Tim Sepak Bola Sma Negeri 1 Dumai. (Doctoral dissertation, Riau University).

Zawawi, A. (2016). Kemampuan Shooting Sepak bola Ditinjau Dari Power Otot Tungkai, Koordinasi Mata-Kaki Dan Keseimbangan Dinamis Pada Siswa Sekolah Sepak bola (Ssb) Garuda Usia 15-17 Tahun Kecamatan Patianrowo Tahun 2016.

Zuhri, S, B. (2021). Hubungan Antara Kekuatan Otot Tungkai, Power Otot Tungkai Dan Koordinasi Mata-Kaki Dengan Kemampuan Shooting Bola Pada Siswa Ssb Putra Gemilang Ponggok Tahun 2020/2021. (Doctoral dissertation, Universitas Nusantara PGRI Kediri)