Turnitin

by M. Rusli

Submission date: 27-Jul-2025 11:30AM (UTC+0800)
Submission ID: 2720992007
File name: Article_Rusli.docx (55.29K)
Word count: 3927
Character count: 21784

CORRELATIONAL STUDY OF ARM MUSCLE STRENGTH WITH LONG SERVICE PERFORMANCE IN BADMINTON ATHLETES

Muhammad Rusli[1], Jud[2], Marsuna[3]
Universitas Halu Oleo, Indonesia[1,2,3]
muhrusli@uho.ac.id, jud_pjok@uho.ac.id, marsuna@uho.ac.id

Abstract
Long serve is one of the basic techniques in badminton that plays an important role in building a game strategy, especially in singles. The ability to perform a consistent and accurate long serve can be a competitive advantage for an athlete. However, the quality of the serve is not only determined by technique, but also by physical factors. This study aims to determine the Correlational study of arm muscle strength with long serve performance in badminton athletes. This type of research is descriptive using a correlational research method. The population of this study was 40 badminton club athletes from Kendari City. The sampling technique was based on purposive sampling, namely the criteria of male gender, age 15-17 years and being able to do long serves, so that the sample numbered 20 people. The research instruments were push-up tests and long serve ability tests. Based on the correlation test analysis, the relationship between the arm muscle power variable coefficient and the upper serve ability was obtained, where the calculated r value was 0.565 at a significance level of 0.008 <0.05 with a determination coefficient of 0.319 or 31.9%. This means that there is a significant relationship between arm muscle strength and long badminton service ability. The contribution of arm muscle strength to long service ability is 31.9% while 68.1% is influenced by other factors. The study concluded that arm muscle strength has a significant relationship with long service performance in badminton athletes.
Keywords*: Strenght, Arm Muscles, Long Serve, Badminton*

INTRODUCTION

Badminton is a sport that requires a combination of technical, tactical, physical, and mental abilities (Marsuna et al., 2024; Hasanuddin & Zainuddin, 2024). This game not only requires speed and precision of movement, but also good mastery of basic techniques, including serving (Abd Kadir et al., 2021). Serving in badminton is not just about starting the game, but is a strategic component that can determine the direction and tempo of the game from the start (Abd Kadir et al., 2021; Gümüş et al., 2024).

One type of serve that is often used, especially in women's singles and mixed doubles, is a long serve. The long serve aims to direct the shuttlecock to the back area of the opponent's court with a high and long trajectory, so that the opponent is forced to play from a less advantageous position (Yane, 2016). The quality of a long serve is determined by several aspects, including proper technique, direction accuracy, and muscle strength, especially arm muscles (Rusli

et al., 2021). Arm muscle strength plays an important role in producing the thrust and speed needed for the shuttlecock to cross the net high and reach the target area precisely. However, in practice, there are still many badminton athletes, especially at the youth development level or beginner athletes, who have difficulty performing long serves well (Saman, 2023).

A common problem that is often encountered is that the shuttlecock does not reach the back area of the court or its direction is inconsistent, which indicates the possibility of weak arm muscle strength or lack of mastery of technique. This indicates the need for research that examines the relationship between arm muscle strength and long serve performance, in order to find the right approach in athlete training and development (Kurniawan et al., 2018).

In general, coaches tend to focus more on improving technical and tactical game skills, but often ignore the specific physical strength aspects that support these technical skills (Subarkah & Marani, 2020; Irham & Puronomo, 2022). Weaknesses in long serve performance are often only associated with a lack of technical training, even though they can also be caused by a lack of essential arm muscle strength in serving with adequate reach and power. The need for an evidence-based training approach. Without supporting scientific data, coaches will have difficulty in designing targeted training programs. If the relationship between arm muscle strength and long serve performance can be proven empirically, then coaches can integrate arm muscle strengthening exercises more systematically into athletes' daily training programs. This is very important, especially in the early stages of athlete development, to develop a physical foundation that supports game techniques.

This study is focused on the study which specifically links arm muscle strength as a physical variable with long serve performance as a technical variable in badminton (Purnama et al., 2024). Previous studies have focused more on the relationship between muscle strength and general game performance, or on overall service skills, without describing in depth the contribution of arm muscle strength to certain types of service. In addition, this study uses a quantitative approach with a correlational method, which allows for objective measurement and statistical

testing of the relationship between the two variables. By using a valid measuring instrument for arm muscle strength and a standardized long serve assessment instrument, the results of this study can provide a more accurate picture of how much muscle strength influences technical performance.

Some real problems that are often encountered in badminton training, especially related to long serve performance include lack of arm muscle strength, especially in adolescent or beginner athletes, causing the shuttlecock not to reach the back area of the court consistently. Inconsistency in long serves, both in terms of strength, accuracy, and the height of the shuttlecock when crossing the net. The coach's ignorance about the direct influence of muscle strength on service quality, so that handling technical problems is often not on target. The solution to these problems is to identify the relationship between arm muscle strength and long serve quality, so that coaches can adjust physical training according to the athlete's technical needs. Provide supporting data that can be used as a reference in designing a more structured arm muscle strengthening training program. Increase the understanding of coaches and athletes about the importance of synergy between physical strength and technical skills. Become a scientific basis in evaluating athlete service performance, so that coaching can be carried out in a more focused and objective manner. The purpose of this study was to determine the relationship between arm muscle strength and long serve performance in badminton.

METHOD

This study method uses a quantitative study of the product moment correlation approach. The valid study population of the Kendari City Badminton Club is 40 individuals. Sampling uses a purposive sampling method based on certain considerations, with the first criteria being male, and being able to play badminton. So the number of participants in this study is 20 athletes. The population that is the focus of this study is all athletes at the Umega Victori club, a total of 40 students.

The instrument of this study is a push-up test (Saiful, 2021), carried out by starting with the body facing down (prone), ready to move. Both legs are

straightened backwards in a close position, attached to each other without any gaps. The arms are bent so that the elbows point backwards, while the palms are placed on the floor parallel to the sides of the chest. The movement is done by lifting and lowering the body, resting on both hands and the tips of the feet (toes). When the body is lifted, both arms must be completely straight as the final form of the upward movement. In each up-and-down movement, the upper body to the feet must form a straight line without bending or curving. When lowering the body, the elbows are bent again, but the chest or other parts of the body should not touch the floor. The repetition count is adjusted according to the starting position: if starting from the bottom position, one count is given after the body returns down; if starting from the top, then one repetition is counted when returning to the top position. For female participants, there is an adjustment in the support position. The support is done using the knees that touch the floor, not on the toes, so the knees must be in a bent position during execution.

Long service test Setiawan, (2021), with warm-up is done by testee is required to do warm-up and stretching first for 5-10 minutes to prevent the risk of injury. Testee stands in the middle of the back side of the court, facing the opponent's court (which has been fitted with target numbers as targets). The standing position is done in the back service area. In the back area of the opponent's court (near the back service line), target numbers (for example 1-5) are placed on the floor surface with a certain distance as a marker for the target direction of the shuttlecock. After the command "yes", the testee performs a long serve towards the target. The service is done 10 times in a row or alternately according to the instructions of the coach or examiner. The shuttlecock must pass over the net and under the upper rope installed above the net (if any). The service is declared valid if the shuttlecock falls in the court and approaches the specified target. If the service is invalid (for example touching the net, going out of court, or failing to touch the target zone), it is still counted as an attempt but is given a score of 0.

Data analysis is done through descriptive analysis which is meant in this study, namely calculating the value, standard deviation, mode, median, average,

maximum, to minimum. So that conducting analysis or correlation test with the aim of assessing the level of relationship with two variables. Before analyzing the correlation, the initial step is to use the normality test and linearity test.

RESULT

The results of measurements of arm muscle strength and the ability to perform long serves in students at the Kendari City Badminton Club show data in the form of average values, standard deviations, highest values, and lowest values from each test that has been carried out.

Table 1. Descriptive Statistics of Arm Muscle Strength (X) and Long Serve Ability (Y)

Variable	Mean	Standard Deviation	Maximum Value	Minimum Value
X	20,85	2,821	25	16
Y	26,10	4,618	34	16

Based on the descriptive statistical data presented in Table 4.1, it is known that the arm muscle strength variable (X) has an average value of 20.85 with a standard deviation of 2.821. The highest value achieved by participants on this variable is 25, while the lowest value was recorded at 16. Meanwhile, for the long serve ability variable (Y), an average of 26.10 was obtained with a standard deviation of 4.618. The score range on this variable is quite varied, with a maximum value of 34 and a minimum value of 16. The difference between the maximum and minimum values on both variables indicates a significant variation in ability among the participants. This can be the basis for designing a more specific training program, especially to improve physical aspects that are directly related to the performance of long serve techniques.

Table 2. Frequency Distribution of arm Muscle Strength

Class Interval	Frequency	Percentage
16 – 17	4	20%
18 – 19	2	10%
20 – 21	5	25%
22 – 23	6	30%
24 – 25	3	15%
Total	20	100%

Table 2 frequency distribution above illustrates the distribution of arm

muscle strength data grouped into several interval classes. Of the total 20 respondents, the majority or around 30% are in the range of 22-23 values, indicating that most participants have moderate to high arm muscle strength. As many as 25% of participants are in the 20-21 class, and 20% are in the 16-17 range, which is the lowest value category in this distribution. Meanwhile, only 10% of respondents have values in the 18-19 range, and another 15% are in the 24-25 interval, reflecting the group with the highest arm muscle strength.

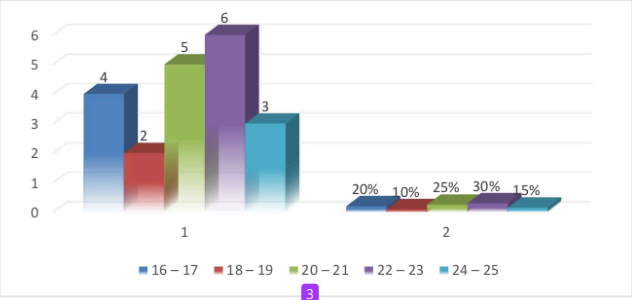

Figure 1. Histogram of Arm Muscle Strength

From this distribution pattern, it can be seen that the arm muscle strength values tend to be spread in the middle group, which means that the data distribution is close to normal, although there is a slight concentration in the middle to upper values.

Table 3. Frequency Distribution of Badminton Long Serves

Class Interval	Frequency	Percentage
16 – 19	4	20%
20 – 23	2	10%
24 – 27	7	35%
28 – 31	3	15%
32 – 35	4	20%
Jumlah	20	100%

Table 3 shows the distribution of long serve ability data based on interval class, number of participants (frequency), and percentage. Of the total 20 participants, the most common group found was in the 24–27 interval, which was

7 people or 35% of the total sample. This shows that most participants have long serve ability at an intermediate level. In addition, there are two groups with the same percentage, namely 20%, each in the 16–19 and 32–35 intervals. This shows that there is a balanced number between participants with low long serve ability and those who have reached a high level. The lowest frequency was recorded in the 20–23 interval, which was only 2 participants or 10% of the total. Meanwhile, 3 participants (15%) were in the 28–31 interval, indicating a small group of participants who have above average abilities, but have not yet entered the highest category.

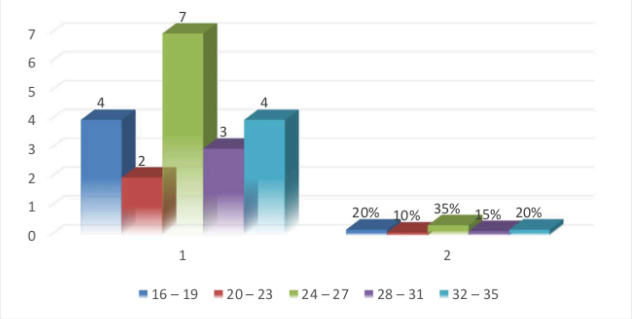

Figure 2. Histogram of Badminton Long Serve

This distribution reflects the variation in ability among participants, with the data tending to be spread around the mean, but still showing the presence of participants with extreme abilities at either end of the scale.

Table 4. Normality Test of Research Data

Variable	Sig	Asymp. Sig	Conclusion
X	0,200	0,05	Normal
Y	0,200	0,05	Normal

The results of the normality test on the variables of arm muscle strength and long service ability show that each has a significance value of 0.200. This value is greater than the specified significance level, which is 0.05. Thus, it can be stated that both variables are normally distributed, because there is no significant difference between the distribution of sample data and the theoretical normal

distribution. This conclusion supports that the data is suitable for analysis using parametric statistical techniques because it has met the assumption of normality.

Table 5. Linearity Test of Research Data

Variable	Significant	Conclusion
X dengan Y	0,970	Linear

The table shows the results of the linearity test between variable X (arm muscle strength) and variable Y (long serve ability). The significance value obtained is 0.970, which is much greater than the significance limit of 0.05. Since the significance value is above the threshold of 0.05, it can be concluded that the relationship between the two variables is linear. This means that the data shows a statistically linear relationship pattern, so that further analysis such as correlation tests or linear regression can be carried out validly.

Table 6. Correlation Test

Correlation Type	r count	Sig 0.05	coefficient of determination	Description
X-Y	0,565	0,008	0,319	Signifikan

The results of the correlation analysis between variables X (arm muscle strength) and Y (long serve ability) showed a calculated r value of 0.565 with a significance level of 0.008. Because the significance value is less than 0.05, it can be concluded that there is a statistically significant relationship between the two variables. The correlation coefficient value of 0.565 indicates that the relationship formed is moderate and positive, which means that the greater the arm muscle strength, the better the participant's long serve ability tends to be. In addition, the determination coefficient of 0.319 or 31.9% indicates that the arm muscle strength variable contributes 31.9% to the variation that occurs in long serve ability, while the rest is influenced by other factors outside the variables studied.

DISCUSSION

This study examines the relationship between arm muscle strength and long serve performance in badminton athletes, with the hope of elucidating the extent to which physical capacity affects the basic techniques that are very crucial in the game. The results of the data analysis showed that there

was a significant positive correlation between arm muscle strength and long serve quality. This means that athletes who have optimal arm muscle strength tend to show better serve performance in terms of distance, accuracy, and consistency. Biomechanically, a long serve is a complex movement that involves a series of coordination between the lower body (to support stability) and the upper body (to generate power). Arm muscle strength, especially the deltoid muscles, biceps, triceps, and other supporting muscles, plays a major role in generating the initial speed of the shuttlecock during service. The energy transfer process starts from the legs and hips, which is then transmitted to the upper body through torso rotation, resulting in a strong arm swing.

Optimal strength ensures that the shuttlecock passes the net with a high trajectory while reaching the target zone on the opponent's court. In this case, the mechanism of muscle work provides adequate acceleration so that the shuttlecock not only flies far, but also has an appropriate trajectory angle, thereby increasing the opportunity to disrupt the opponent's defense.In this study, arm muscle strength measurements were carried out using standardized quantitative instruments. The data showed that athletes with higher arm muscle strength measurement values tended to achieve better long serve scores ((Marwan et al., 2022). This indicates that there is a causal relationship, although this study is correlational, which suggests that increasing arm muscle strength can contribute to improving the quality of long serve techniques (Susila & Pratama, 2022).

Various previous studies have revealed the relationship between physical aspects and technical performance in racket sports, so the findings in this study are in line with existing literature, namely according to Ibrohim et al., (2022), the study found that athletes who have greater arm muscle strength show better stroke accuracy and stability in ball exchanges in match situations. This finding is in line with research results showing that arm muscle strength plays an important role in producing accurate and powerful

serves. According to Wijaya et al., (2025), in a study conducted on adolescent athletes, Nurhayati and Rahman identified a positive correlation between arm muscle strength and long serves. The results indicate that increasing arm muscle strength generally has a positive impact on attack performance, which can then be applied to long serve techniques. This provides empirical support for the importance of strengthening arm muscles in increasing service effectiveness.

In general, previous literature and research provide a strong basis that increasing arm muscle strength will contribute positively to improving technical performance, including long serves. These studies not only confirm the findings of this study, but also expand the understanding that the integration of strength training and technical training must work synergistically to produce more competitive athletes.

The results of this correlational study have several important implications that can be applied in the context of badminton training, physical education curriculum development, and further research in the field of sports science (Marani & Subarkah, 2023). The main implication is that the results of this study provide a strong basis for coaches to integrate arm muscle strengthening exercises into daily training programs. Weight training, resistance training, and variations of functional exercises such as push-ups, medicine balls, and the use of resistance bands can be added with an emphasis on service techniques. Thus, training is not only focused on the service technique itself, but also on increasing the physical strength that supports the technique (Nur et al., 2018). With objective arm muscle strength measurement parameters, coaches can conduct periodic evaluations of athletes' physical development. This allows early identification of athletes who have potential but have not optimized their physical strength, so that adjustments to the training program can be made appropriately and in a targeted manner.

CONCLUSION

There is a positive and significant relationship between arm muscle

strength and long serve performance in badminton athletes. The higher the arm muscle strength of the athlete, the better the quality of the long serve produced, both in terms of distance, accuracy, and consistency. Arm muscle strength contributes directly to the athlete's ability to push the shuttlecock across the net with a high trajectory and reach the back area of the opponent's court, which is the essence of long serve in badminton. This study also provides a scientific basis for coaches to develop training programs that not only emphasize service techniques, but also pay attention to specific physical conditions that support service performance, especially arm muscle strength.

REFERENCES

Abd Kadir, S., Aimang, H., & Nur, A. (2021). Hubungan Koordinasi Mata Tangan Terhadap Keterampilan Servis Pendek Bulutangkis Mahasiswa Penjaskesrek Universitas Muhammadiyah Luwuk. *BABASAL Sport Education Journal*, *2*(2), 65–71. https://doi.org/10.32529/bsej.v1i2.1601

Gümüş, M., UDUM, Y., SUVEREN ERDOĞAN, C., & ÇAKIR, V. (2024). Do Isokinetic Strength and Shoulder Mobility Influence Ball Velocity? A Study of Female Badminton Players. *International Journal of Religion*, *5*(5). https://doi.org/10.61707/jfxr3c06

Hasanuddin, M. I., & Zainuddin, M. S. (2024). Analisis Tingkat Keberhasilan Servis Pendek Forehand Dalam Permainan Bulutangkis. *Jurnal Dunia Pendidikan*, *4*(3), 1471–1480. https://doi.org/10.55081/jurdip.v4i3.2101

Ibrohim, I., Setiawan, A., & Agustin, N. M. (2022). Hubungan Kekuatan Otot Lengan dan Koordinasi Mata-Tangan Dengan Ketepatan Servis Long Forehand Bulutangkis. *Jurnal Penjakora*, *9*(1). https://doi.org/10.23887/penjakora.v9i1.46364

Irham, A. I., & Puronomo, M. (2022). Analisis Kondisi Fisik Atlet Putra Bulutangkis PB Wiman Lamongan Usia 15-17 Tahun. *Jurnal Prestasi Olahraga*, *5*(5), 5–12. https://ejournal.unesa.ac.id/index.php/jurnal-prestasi-olahraga/article/view/46944

Kurniawan, B. T., Khaeroni, K., & Sukriadi, S. (2018). Meningkatkan Hasil Belajar Servis Panjang (Forehand) Permainan Bulutangkis Dengan Media Raket Kayu. *Jurnal Pendidikan Jasmani Dan Adaptif (JPJA)*, *1*(02), 51–57. https://doi.org/10.21009/jpja.v1i02.11016

Marani, I. N., & Subarkah, A. (2023). Pengaruh Kelentukan Togok, Koordinasi Dan Power Otot Lengan Terhadap Hasil Pukulan Smash Pada Olahraga Bulutangkis. *Jurnal MensSana*, *8*(2), 96–102. https://doi.org/10.24036/MensSana.08022023.13

Marsuna, M., Rusli, M., Jud, J., & Asshagab, M. (2024). Correlation of Arm Muscle Power and Abdominal Muscle Strength with Badminton Smash Ability. *Physical Activity Journal (PAJU)*, *5*(2), 115–122.

https://doi.org/10.20884/1.paju.2024.5.2.11611
Marwan, M. R., Fauzi, M. S., & Naheria, N. (2022). Analisis Keterampilan Servis Pendek Dan Servis Panjang Atlet PB. Hollywood Kota Samarinda. *Borneo Physical Education Journal*, *3*(1), 1–7. https://doi.org/10.30872/bpej.v3i1.934
Nur, A., Muin, M., & Akhmady, A. L. (2018). Pengaruh kekuatan otot lengan dan koordinasi mata-tangan terhadap hasil servis panjang bulutangkis mahasiswi program studi pendidikan olahraga stkip kie raha ternate. *Jurnal Pendidikan Olahraga*, *8*(2), 63–67. https://doi.org/10.37630/jpo.v8i2.149
Purnama, A. R., Kusdinar, Y., & Kardjono, K. (2024). The Relationship Between Wrist Flexibility and Arm Muscle Strength with the Accuracy and Speed of Smash for Badminton Athletes Universitas Pendidikan Indonesia (UPI). *Journal of Physical Education Health and Sport*, *11*(2), 75–78. https://doi.org/10.15294/jpehs.v11i2.18563
Rusli, M., Jumareng, H., & Maruka, A. (2021). Hubungan Power Otot Lengan Dengan Kemampuan Melakukan Servis Panjang Pada Permainan Bulutangkis Pada Siswa Putra Kelas Viii Smpn 1 Wangi-Wangi. *Journal Olympic (Physical Education, Health and Sport)*, *1*(1), 1–12. https://doi.org/10.36709/olympic.v1i1.2
Saiful. (2021). *Tes dan Pengukuran dalam Olahraga*. UD Al Hasanah.
Saman, A. (2023). Hubungan Koordinasi Mata Tangan dengan Kemampuan Servis Panjang Permainan Bulutangkis pada Mahasiswa Jurusan Ilmu Keolahragaan Angkatan 2020 FKIP Universitas Halu Oleo. *JOKER (Jurnal Ilmu Keolahragaan)*, *4*(1), 25–30. https://joker.uho.ac.id/index.php/journal/article/view/15
Setiawan, E. (2021). *Tes, Pengukuran dan Evaluasi dalam Pendidikan Jasmani dan Olahraga*. Alvabeta,CV.
Subarkah, A., & Marani, I. N. (2020). Analisis teknik dasar pukulan dalam permainan bulutangkis. *Jurnal MensSana*, *5*(2), 106–114. https://doi.org/10.24036/MensSana.050220.02
Susila, L., & Pratama, S. A. (2022). Studi Perbandingan Prestasi Servis Panjang dengan Menggunakan Servis Forehand dan Servis Backhand Terhadap Ketepatan Sasaran dalam Permainan Bulu Tangkis pada Club PB Satria Dompu. *Journal Transformation of Mandalika*, *3*(3), 74–81.
Wijaya, S. F., Simanjuntak, V. G., & Yanti, N. (2025). Hubungan Kekuatan Otot Lengan Terhadap Servis Panjang Dalam Permainan Bulutangkis Pada Atlet Pemula Putra PB Camp 43 Pontianak. *Jurnal Dunia Pendidikan*, *5*(5), 1523–1534. https://doi.org/10.55081/jurdip.v5i5.3774
Yane, S. (2016). Peningkatan servis panjang bulutangkis melalui model problem based learning. *Jurnal Pendidikan Olah Raga*, *5*(2), 165–174. https://doi.org/10.31571/jpo.v5i2.384

Turnitin

ORIGINALITY REPORT

11%	7%	10%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	joker.uho.ac.id Internet Source	2%
2	Muslimin Muslimin, Destriana Desrtiana. "Relação entre o comprimento do braço, a força muscular do braço e a coordenação mão-olho no desempenho do serviço superior na equipa de voleibol Garuda Jaya Sumatra", Retos, 2025 Publication	2%
3	Muhammad Sukron Fauzi, Didik Cahyono, Paryadi Paryadi, Gyta Krisdiana Cahyaningrum et al. "Correlation of Height and Arm Muscle Strength o Volleyball Serving Ability of Health Vocational School Students", Indonesian Journal of Innovation Multidisipliner Research, 2024 Publication	1%
4	Saki Saki, Budi Usodo, Eka Budhi Santosa. "Effectiveness of augmented reality application on critical thinking skills of elementary school students based on learning interest", Jurnal JPSD (Jurnal Pendidikan Sekolah Dasar), 2025 Publication	1%
5	www.scilit.net Internet Source	1%
6	jurnal.univpgri-palembang.ac.id	

	Internet Source	1 %
7	ojs.uniska-bjm.ac.id Internet Source	1 %
8	Afi Ningsih, Muhammad Rusli, La Sawali. "HUBUNGAN POWER OTOT TUNGKAI DENGAN KEMAMPUAN TENDANGAN MAWASHI GERI ATLET KARATE INKANAS RANTING SMK NEGERI 3 BAUBAU", Journal Olympic (Physical Education, Health and Sport), 2023 Publication	1 %
9	www.ijmra.in Internet Source	1 %
10	jist.publikasiindonesia.id Internet Source	1 %

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		