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The effect of jumping rope and calf raise exercises on students' leg muscle strength

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Abstract

This study aims to analyze the effect of Jumping-rope and Calf-rise training on increasing leg muscle strength. The type of research is a quasi-experiment with the non-randomized pretest posttest control group design. The research subjects were 30 people. Leg muscle strength was measured using the Leg dynamometer test and the data were analyzed using a one-way ANOVA test, followed by the least significant difference (LSD) test at a significance level (a) of 0.05 with the help of the SPSS 16.0 computer program. Description of research data from the variable leg muscle strength in the Calf-Rise group which increased by 3.70, the Jumping-Rope group experienced an increase of 5.80, and the control group experienced an increase of 2.40. The results of data analysis using the one-way ANOVA test showed that Jumping-Rope and Calf-Rise training had an effect on increasing leg muscle strength with a significance value of 0.000 (sig <0.05) and there were differences in the influence of each group. Based on the least significant difference (LSD) test, it was found that the Jumping-Rope training mean difference was 2.10000, which was better than the Calf-Rise training mean difference of -2.10000. The results of this research can be concluded that: (1) Jumping-Rope and Calf-Rise research has an effect on increasing leg muscle strength, (2) There is a difference in the influence between Jumping-Rope and Calf-Rise training which has an effect on increasing leg muscle explosive power, where training Jumping-Rope has a better effect than Calf-Rise training in increasing leg muscle strength. For sports players, it is recommended that they use Jumping-Rope and Calf-Rise training as a way to increase Leg Muscle strength

Keywords: *Jumping Rope, Calf Rise, Leg Muscle Strength*

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INTRODUCTION

Sport is one of a person's physical and psychological activities that is useful for maintaining and improving the quality of a person's health. The word sport comes from Old French *"sports"* which means "pleasure" (Prasetya et al., 2021). Apart from that, it can be interpreted as anything that is exciting and entertaining for humans. Sports is one of the main sources of entertainment, therefore there are sports supporters who are generally divided into a large number of people and can be broadcast more widely through sports broadcasts according to (Kuntjoro, 2020).

Sport is one of a person's physical and psychological activities that is useful for maintaining and improving the quality of a person's health after exercise (Suryadi & Rubiyatno, 2022). Islam views that health is very important because health is a human right, something that is in accordance with human nature because Islam is a perfect and comprehensive religion, which covers all aspects of human life Salahudin & Rusdin, (2020). So exercise is one of a person's physical and psychological activities that is useful for maintaining and improving the quality of a person's health after exercise (Apriyanto et al., 2021). Sport is an activity carried out to train a person's body, both physically and spiritually. Most people usually only define exercise as an activity that is deliberately carried out to improve or maintain body health (Salahudin & Rusdin, 2020). Therefore, people who do physical activity are called sports.

One of the sports that is currently popular is karate. Karate can be done with the aim of encouraging the potential and development and talents of students (Asnaldi, 2015). Apart from that, karate activities foster discipline, mutual respect, a spirit of sportsmanship, and accountability in decision making Ajat Rukajat et al., (2021). Karate is a martial sport that requires high levels of skill, technique and self-confidence to be able to play well and consistently in matches Irwansyah et al., (2022).

The development of the sport of karate, especially for female students, especially at elementary, middle school, high school/vocational school levels at events such as PORSENIJAR at district and provincial levels, has not shown increased development results due to inhibiting factors such as a lack of ability to punch and kick in each match. This is due to the lack of ability that every karateka has so that punches and kicks become less accurate. Nowadays, leg muscle strength is important for a prospective athlete because the leg muscles will support an athlete's body when making movements (Syamsudin et al., 2022). If an athlete has good leg muscle strength, it can minimize injuries experienced by an athlete, not only that, the leg muscle strength that an athlete has can make the body feel lighter and the movements a karateka makes will be freer, starting from sliding, punches, kicks, parries, dodge attacks. especially in the sport of Karate because a karateka must have good stances in numbers *SAY* nor *KUMITE*.

Like other sports, karate requires a very good level of physical condition. Apart from mental, technical and tactical aspects, physical condition is very important to improve athlete performance (Syamsudin et al., 2022). Physical condition is a unit that cannot be separated, both in terms of improvement and maintenance (Adnyana et al., 2022). This means that improving physical condition involves all physical components without exception. To improve

an athlete's performance, various kinds of physical condition development are needed. To increase strength, training programs must be carried out carefully, systematically, regularly and always improving, following the principles and accurate training methods in order to achieve the expected goals Irwansyah et al., (2022).

Based on the researcher's observations while at the Dojo, when participating in competitions, athletes often fall when carrying out attacks in kumite events. Likewise with kata numbers, in a kata competition, the horse that a karate athlete has must be strong because if the horse's horse sways it can affect the assessment even though the athlete has *power* loudness, speed, and the number of words being played (Ningsih, 2023). This problem is caused by a lack of training regarding leg muscle strength which is rarely trained, so far training in the bull dojo prioritizes attack speed training, *power* attacks and match techniques. This leg muscle strength training is very rarely trained, resulting in a lack of ability to strengthen the leg muscles (Julianto et al., 2019).

Based on these problems, innovation is needed to increase the ability of leg muscle strength, one of which is through training *Jumping Rope* and *Calf Rise*. This training can focus on lower leg muscle training in the shortest possible time (Fitness et al., 2022). For this reason, students will be divided into two groups to find out between the exercises *Jumping Rope* or *Calf Rise* The most effective exercise to increase leg muscle strength. *Jumping Rope* is or jumping rope is a simple sport that is good for health (Kharis Moctar et al., 2021). Apart from being able to train leg muscle strength, this exercise also helps with dieting because it reduces a lot of calories. Jumping rope relaxes the calves and core, increases stamina, and increases lung capacity (Najiah et al., 2021). With this exercise, the brain will focus on the legs so that you can jump well. In this research, *jumping rope* can help the brain and the rest of the body become more balanced. *Calf Raise* is a simple but effective exercise movement to strengthen the calf muscles. The calf muscles are two large muscles in the back of the leg that help a person move, walk and run. One of the exercises that trains the calf muscles is *calf raise*, which was carried out in this research to train calf muscle strength (Aditya et al., 2021).

Based on this explanation, this research was carried out with the aim of analyzing the effect of Jumping-rope and Calf-rise training on increasing leg muscle strength. Through this research, it is hoped that it can provide deeper insight into the effectiveness of jumping rope and calf raise exercises in increasing leg muscle strength. It is hoped that the results of this research can be a reference for fitness trainers, athletes and individuals who want to increase leg muscle strength.

METHOD

This research is experimental research which aims to determine whether there are consequences from something imposed on the research subject. The type of experimental used is quasi experimental, with the aim of exploring information which is a rationale for information that can be obtained with actual experiments in circumstances where it is impossible to control or manipulate all relevant variables.

The research subjects are all the variants that are the research material. Research subjects are objects, things/people, places and research variables that are inherent and at issue. In this research, the research subjects used were Tabanan Bull Dojo students, totaling 16 adults and divided into two groups, namely group 1 with a total of 8 people and group 2 with a total of 8 people.

Data collection is the most crucial stage in a research in order to obtain the desired results. In this study, it was obtained from measuring the dependent variable, namely leg muscle strength. These data are initial test data (pre-test) and final test (post-test). The final test was carried out after the treatment students were given jumping rope and calf rise training. Next, it is analyzed based on the measurement results of each student.

Data analysis techniques: Before carrying out data analysis, several requirements that must be fulfilled are the data normality test and the data homogeneity test (U. Usmadi, 2020). After passing the prerequisite tests, the data is processed using inferential statistics to test the hypothesis. Hypothesis testing was carried out using one-way ANOVA with the help of the SPSS 16.0 program (Handayani & Hernando, 2022).

RESULTS

Testing of the normality of research data was carried out on different data (Gain Score) from leg muscle strength data in the jumping rope and calf rise training treatment groups using the Lilliefors test at a significance level of $\alpha=0.05$. The decision making criteria is if the value Lcount < Ltable, so the null hypothesis is accepted. So the sample data comes from a normally distributed population. Meanwhile, if the value of Lcount < Ltable, then the sample does not come from a normally distributed population. A summary of the results of the data normality test can be seen in table 1.

Table 1. Normality test results

Group	L count	L table (0.05)	Information
Calf rise	0.1770	0.2580	Normal distribution
Jumping rope	0.1985	0.2580	Normal distribution
Control group	0.1830	0.1830	Normal distribution

From the results of the data normality test using the Lilliefors test, for the calf rise training group the Lcount result was 0.1985 with Ltable 0.2580. Meanwhile, for the jumping rope training group, the Lcount result was 0.1770 with Ltable 0.2580. If the Lcount value obtained is < Ltable, then the subject has a normal distribution. From the analysis above, it appears that the leg muscle strength data has a calculated L value that is smaller than the L table. So both of the groups have a normal distribution.

After the data is declared to be normally distributed, it is continued with a homogeneity test. Data homogeneity tests were carried out on gain score data from leg muscle strength data in the jumping rope and calf rise training treatment groups with the help of SPSS 16.0 at a significance level (α) of 0.05. Decision making criteria, namely if the calculated significance value is >α, then the data variance is homogeneous. Meanwhile, if the calculated significance obtained is <α, then the data variation is not homogeneous. A summary of the results of the levene test using SPSS 16.0 for the data homogeneity test can be seen in table 2

Table 2. Homogeneity test results

Data source	Number of groups	Levene statistics	Df1	Df2	Sig. count	is
Group leg muscle strength *jumping rope*, *calf rise,*control	3	0.311	2	27	0,735	Varian homogen

From the data homogeneity test using the Levene test with the help of SPSS 16.0, we obtained a test value of 3.11 with a calculated significance of 0.735 for the leg muscle strength variable. If the calculated significance value obtained is >α, then the data variance is homogeneous. Thus, the significance value is 0.735 > 0.05, so the data tested comes from homogeneous data.

After passing the prerequisite tests, data analysis can continue with hypothesis testing. The hypothesis that jumping rope and calf rise training has an effect on leg muscle strength with one-way avana with the help of the SPSS 16.0 program at a significance level of α= 0.05. The research hypothesis is accepted if the avana value has a significance smaller than α (Sig < 0.05). Meanwhile, if the calculated significance value is greater than α (Sig > 0.05), the research hypothesis is rejected. The data tested were the gain-score of the control group, the jumping rope and calf rise training treatment groups for leg muscle strength. The test results can be seen in table 3.

Table 3. Hypothesis test results

	Sum of squares	df	*Mean square*	F	*Significance*
Between Groups	58.864	2	29.433	15.862	0.000
Within Groups	50.100	27	1.856		
Total	108.967	29			

From the results of Avana, the significance (0.000) is smaller than the α value (Sig < 0.05). Because the significance of the two trainings is (0.000) smaller than the α value, the research hypothesis that jumping rope and calf rise training have an effect on leg muscle strength is accepted. Based on the results of the one-way ANOVA test with the significance value (0.000) being smaller than the α value (Sig < 0.05), each group gave different results regarding leg muscle strength. Because there were differences in the influence of each group, a further test or least significant difference (LSD) comparison test was carried out to find out which training had a better effect on increasing leg muscle strength with the help of SPSS 16.0 at a significance level (α) of 0.05.

To find out which training has a better effect on increasing leg muscle strength, this is done by differentiating the values based on the mean difference. Decision making criteria are based on the largest value of the mean difference and the presence or absence of an ast (*) sign in the "mean difference" column. If the ast sign (*) is in the mean difference number, then the difference is real or significant. So the training that gets the biggest score and has an ast mark (*) is the training that has a better impact on improvement. So the training that gets the greatest value is training that has a better effect on increasing leg muscle strength.

Table 4. LSD Test Results for Leg Muscle Strength

(I) Group	(II) Group	*Mean Difference* (I-J)	Std. Error	Say.	95% *confidence interval*	
					Lower bound	*Upper bound*
Calf rise	*Jumping rope*	-2.10000*	0.60919	0.002	-3.3500	-0.8500
	Control	1.30000*	0.60919	0.042	0.0500	2.5500
Jumping rope	*Calf rise*	2.10000*	0.60919	0.002	0.8500	3.3500
	Control	3.40000*	0.60919	0.000	2.1500	4.6500
Control	*Calf rise*	-1.30000*	0.60919	0.042	-2.5500	-0.0500
	Jumping rope	-3.40000*	0.60919	0.000	-4.6500	-2.1500

The results of the least significant difference (LSD) test showed that the significance value for all groups was smaller than α (Sig < 0.05), which means there could be significant differences in all groups. Furthermore, looking at the results of the mean difference in leg muscle strength, it was found that the calf rise training group was smaller than the jumping rope training by -2.10000* and the calf rise training group was greater than the control group by 1.30000*. The mean difference results from the jumping rope training group were greater than the calf rise training group by 2.10000* and the jumping rope training group was greater than the control group by 3.40000*. while the mean difference results in the control group were smaller than the calf rise training by -1.30000* and the control group was smaller than the jumping rope group by -3.40000*.

So, from the results of the least significant difference (LSD) test for leg muscle strength, jumping rope training has a better effect on leg muscle strength with a mean difference of 2.10000*. So the research hypothesis is that jumping rope training is more effective in increasing the leg muscle strength of Tabanan Banteng Dojo students.

DISCUSSION

The results of research analysis for research-related variables show an increase in the average value for the leg muscle strength variable. in both treatment groups there was an increase in the average value of the variable and in the control group there was also an increase (Asrizal & Fitra, 2020). From the description above, it is known that there was an increase in the variable value of leg muscle strength in both treatment groups. The improvement experienced by both treatment groups was due to the training carried out (Priwijaya et al.,

2023). The form of training for the jumping rope and calf rise treatment carried out is training with a training frequency of 3 times a week for 4 weeks.

One simple but effective exercise movement to strengthen the calf muscles is calf raises (Afrizal, 2018). The calf muscles are two large muscles in the back of the legs that help you move, walk and run. One of the exercises that trains the calf muscles is the calf raise, which was carried out in this study to train the strength of the calf muscles to perform the calf raise movement (Agustin et al., 2018). The Calf Rise movement that is done repeatedly causes stress on the muscle components of the legs so that the body's organs will adapt. The adaptation experienced is hypertrophy, an increase in muscle mass. Muscle hypertrophy is caused by an increase in the diameter of muscle fibers, while the number of muscle fibers does not appear to have an effect on regular exercise (Keolahragaan et al., 2021). So the training provided can cause physiological adaptations to muscles in the form of muscle hypertrophy, an increase in the number of muscles, an increase in the number of mitochondria, increased muscle strength so that it can increase leg muscle strength. Based on this explanation, it can be concluded that calf raise training has an effect on leg muscle strength (Akbar Syahruna & Nurhidayat, 2022).

Jumping Rope or jumping rope is a simple exercise that is good for your health. Jumping rope It also helps diets because it reduces a lot of calories (Irwansyah et al., 2022). Jumping rope relaxes the calves and core, increases stamina, and increases lung capacity. With this exercise, your brain will focus on your feet so you can jump well. In this study, jumping rope can help the brain and the rest of the body become more balanced Fitness et al., (2022). Muscle strength increases through adaptation of the nervous system which allows the subject to move the number of movement units to increase at a time from the training given and because the increase in muscle automatically increases the number of muscle cells, where there are additional mitochondria (Alim, 2020). So the training provided can cause physiological adaptations to muscles in the form of muscle hypertrophy, an increase in the number of muscles, an increase in the number of mitochondria, increased muscle strength so that it can increase leg muscle strength. Based on this, it can be stated that jumping rope training has an effect on leg muscle strength (Dewi et al., 2022).

From the results of the one way ANOVA test analysis, a significance level of 0.000 was obtained at a significance level of 0.05. The calculated significance value is smaller than the significance value α (Sig < 0.05), so it can be concluded that there are differences in the influence of each group. Further test results (LSD). Decision making criteria can be seen in the output in the mean difference column. Theoretically, the research results show a difference in

the effect between Jumping Rope and Calf Rise training on leg muscle strength (Fitriady et al., 2020). If you look at the data obtained, the Jumping Rope exercise is better than the Calf Rise exercise for increasing leg muscle strength. through training loads and increasing sets given progressively, this will indirectly result in muscle adaptation with changes in the leg muscles both in terms of number and size. This training was carried out for 4 weeks or 12 meetings with a frequency of 3 times per week. with the frequency and duration of training that has been programmed, this research has been able to answer several existing hypotheses (Altmann et al., 2019).

This research has the advantage of being able to show that both types of exercise are effective in increasing leg muscle strength, which is very beneficial for improving athletic performance and preventing injury (Dewi, 2021). Jumping rope and calf raises are also simple exercises and do not require expensive equipment, so they are easily accessible to various groups (Eler & Acar, 2018). The implication of this research is that it can be applied in fitness training and physical rehabilitation programs, especially for individuals who want to increase leg muscle strength and stability (Barahona-Fuentes et al., 2020). This can also affect athletes' training in various sports that require strong leg muscle strength (Susanti et al., 2022). However, this research may have limitations in terms of the sample used, for example a small sample size or lack of diversity. So for further research, it is recommended to involve a larger and more diverse sample to get more generalizable results.

CONCLUSIONS

Based on the results of data analysis and discussion, in this study it can be concluded that jumping rope training has an effect on increasing leg muscle strength, Calf Raise training has an effect on increasing leg muscle strength, and jumping rope training is more effective in increasing leg muscle strength of Tabanan Banteng Dojo students. The results of this research can be used to design more effective and efficient training programs, especially for sports that require optimal leg strength, such as running, football and basketball. Apart from that, this research can also be applied in medical rehabilitation programs to speed up recovery from leg muscle injuries..

REFERENCES

Aditya, P. K., Juwita, J., & Supriyanto, S. (2021). A Correlation Between Leg Muscle Explosive Power And Ankles Coordination On The Shooting Accuracy In Soccer Games In Sukasari Village Club. *Hanoman Journal: Physical Education and Sport*, *2*(1), 7–12. https://doi.org/10.37638/hanoman.v2i1.281

Adnyana, I. K. S., Astra, I. I. B., Muliarta, I. W., Gunarto, P., & Suwiwa, I. G. (2022). Proceedings of the 2nd International Conference on Physical Education, Sport, and Health

(ICoPESH 2022). In *Proceedings of the 2nd International Conference on Physical Education, Sport, and Health (ICoPESH 2022)*. Atlantis Press SARL. https://doi.org/10.2991/978-2-494069-79-4

Afrizal. (2018). Dayaledak Otot Tungkai Dan Kelentukan Berkontribusi Terhadap Akurasi Shooting Sepakbola. *Jurnal Performa Olahraga*, *3*, 6–14. https://performa.ppj.unp.ac.id/index.php/kepel/article/view/15

Agustin, R. B., Kumaidah, E., & Bakri, S. (2018). Pengaruh Latihan Skipping Terhadap Tingkat Konsentrasi Mahasiswa Fk Undip. *Diponegoro Medical Journal (Jurnal Kedokteran Diponegoro*, *7*(4), 1763–1773.

Ajat Rukajat, K., Tauhidin Abas, T., & Nugraha Gusniar, I. (2021). Pelatihan Seni Bela Diri Karate Teknik Zenkutsu Dachi Pada Siswa Smp Negeri 1 Karawang Barat. *Jurnal Pendidikan Tambusai*, *5*(3), 8065–8069.

Akbar Syahruna, D., & Nurhidayat, N. (2022). Analisis Keterampilan Shooting dan Passing Pada Sekolah Sepak Bola. *Jurnal Porkes*, *5*(2), 706–716. https://doi.org/10.29408/porkes.v5i2.6522

Alim, A. (2020). Studi manajemen pelatih dan atlet pada pembinaan prestasi cabang olahraga tenis lapangan. *Jorpres (Jurnal Olahraga Prestasi*, *16*(1), 19–28. https://doi.org/10.21831/jorpres.v16i1.29989

Altmann, S., Ringhof, S., Neumann, R., Woll, A., & Rumpf, M. C. (2019). Validity and reliability of speed tests used in soccer: A systematic review. *PLoS ONE*, *14*(8), 1–38. https://doi.org/10.1371/journal.pone.0220982

Apriyanto, T., Marani, I. N., & Banyunimas, T. P. (2021). Analisis durasi pertandingan bolavoli pada Proliga 2019 ditinjau dari sistem energi. *Jurnal Keolahragaan*, *9*(1), 86–99. https://doi.org/10.21831/jk.v9i1.33784

Asnaldi, A. (2015). Analisis Kondisi Fisik Dalam Cabang Olahraga Karate. *Sport Science: Jurnal Ilmu Keolahragaan dan Pendidikan Jasmani*, *24*(29), 13–28.

Asrizal, C. W., & Fitra, F. (2020). Pengaruh latihan aerobik terhadap fungsi Kognitif, mood dan proses aging pada sistem saraf pusat. *Jurnal Kedokteran Nanggroe Medika*, *3*(1), 16–20.

Barahona-Fuentes, G. D., Ojeda, Á. H., & Jerez-Mayorga, D. (2020). Effects of different methods of strength training on indicators of muscle fatigue during and after strength training: A systematic review. In *Motriz. Revista de Educacao Fisica* (hal. 1–20). https://doi.org/10.1590/S1980-6574202000030063

Dewi, K. A. K. (2021). Pengaruh Pelatihan Jump Rope Terhadap Daya Ledak Otot Tungkai Pada Perenang Usia Dini. *Jurnal Ilmiah Pendidikan Citra Bakti*, *8*(2), 215–222. https://doi.org/10.38048/jipcb.v8i2.327

Dewi, K. A. K., Ni Gusti Ayu Lia Rusmayani, I. K. A. P. I., Hita, I. P. A. D., & RAISE. (2022). Perbandingan Pengaruh Pelatihan Calf Raise, Jump Rope, Dan Butt Kick Terhadap Peningkatan Kekuatan Dan Kecepatan Otot Tungkai Dalam Olahraga Renang. *Jurnal Kejaora (Kesehatan Jasmani Dan Olah Raga)*, *7*(1), 56–63. https://doi.org/10.36526/kejaora.v7i1.1926

Eler, N., & Acar, H. (2018). The effects of the rope jump training program in physical education lessons on strength, speed and VO 2 max in children. *Universal Journal of Educational Research*, *6*(2), 340–345. https://doi.org/10.13189/ujer.2018.060217

Fitness, C., Siswa, P., & Jakarta, S. (2022). *Efek latihan skiping dan joging*. *2*(2).

Fitriady, G., Sugiyanto, & Sugiarto, T. (2020). Gelanggang Pendidikan Jasmani Indonesia. *Gelanggang Pendidikan Jasmani Indonesia*, *3*(2), 82–90.

http://journal2.um.ac.id/index.php/jpj

Handayani, V. A., & Hernando, L. (2022). Penerapan Aplikasi Uji Hipotesis (One-Tail Dan Two-Tail) pada Data Simulasi. *Jurnal CoSciTech (Computer Science and Information Technology)*, *3*(2), 168–174. https://doi.org/10.37859/coscitech.v3i2.3869

Irwansyah, R., Faizal, A., Paranoan, A., Wahyudi, A., & Aryanti, N. E. (2022). *Analisis Profil Kondisi Fisik Atlet Pelatnas Karate Indonesia Pada Sea Games 2022*. *4*(2), 14–21.

Julianto, A., Sugihartono, T., & Sutisyana, A. (2019). Pengaruh Latihan Kekuatan Otot Tungkai Dengan Beban Berbasis Pantai Terhadap Peningkatan Kemampuan Lari 50 Meter Siswa Ekstrakurikuler Smp Negeri 8 Kaur. *Kinestetik*, *3*(2), 157–164. https://doi.org/10.33369/jk.v3i2.8910

Keolahragaan, F. I., Jakarta, U. N., Ganesha, U. P., & Teaching, M. (2021). *Penggunaan Video Reflektif Untuk Meningkatkan Keterampilan Menjelaskan Pada Mata Kuliah Microteaching : Persepsi Mahasiswa Penjaskesrek I Ketut Semarayasa 1 , Ni Luh Putu Spyanawati 1 , I Made Satyawan 1 1*.

Kharis Moctar, M., Yanuar Rizky, M., & Muharram, N. A. (2021). Pengaruh Latihan Circuit Training Terhadap Aerobik Sistem Dan Stamina Pada Pemain Sepakbola Usia 13. *Jurnal Porkes*, *4*(2), 189–197. https://doi.org/10.29408/porkes.v4i2.5000

Kuntjoro, B. F. T. (2020). Rasisme Dalam Olahraga. *Jurnal Penjakora*, *7*(1), 69. https://doi.org/10.23887/penjakora.v7i1.19503

Najiah, W. N., Lee, E. L. Y., Malek, N. F. A., Malik, Z. A., Chan, E. W. M., Ghazali, N., & Nadzalan, A. M. (2021). Relationship between Leg Dynamometer with Squat and Deadlift 1RM Score among University Athletes. *Journal of Physics: Conference Series*, *1874*(1). https://doi.org/10.1088/1742-6596/1874/1/012089

Ningsih, N. P. (2023). *Pengaruh Latihan Resistance Band Terhadap Peningkatan Daya Tahan Kekuatan Otot Tungkai Atlet Sepak Bola Neo Angel Mataram*. *10*(1), 90–96.

Prasetya, N. A., Chaerul, A., & Kusuma Yuda, A. (2021). Hubungan Kekuatan Otot Tungkai dengan Ketepatan Smash pada Ekstrakurikuler Bola Voli. *Jurnal Literasi Olahraga*, *1*(2). https://doi.org/10.35706/jlo.v1i2.3947

Priwijaya, A., Mahmudah, R., Basit, M., & Manto, O. A. D. (2023). Hubungan Teknik Pemanasan Terhadap Resiko Low Back Pain Pada Pemain Basket Di Universitas Sari Mulia Banjarmasin. *Jurnal Ilmiah Keperawatan (Scientific Journal of Nursing)*, *9*(5), 664–668. https://doi.org/10.33023/jikep.v9i5.1758

Salahudin, S., & Rusdin, R. (2020). Olahraga Meneurut Pandangan Agama Islam. *JISIP (Jurnal Ilmu Sosial dan Pendidikan)*, *4*(3), 457–464. https://doi.org/10.58258/jisip.v4i3.1236

Suryadi, D., & Rubiyatno. (2022). Peningkatan Kemampuan Shooting Permainan Sepak Bola Melalui Latihan Kekuatan Otot Tungkai. *Jurnal Pendidikan Kesehatan Rekreasi*, *8*(2), 237–246. https://doi.org/10.5281/zenodo.6684431

Susanti, R., Sidik, D. Z., Hendrayana, Y., & Wibowo, R. (2022). Latihan Pliometrik dalam Meningkatkan Komponen Fisik: A Systematic Review. *JOSSAE Journal of Sport Science and Education*, *6*, 156–171. https://doi.org/10.26740/jossae.v6n2.p156-171

Syamsudin, A. A., Amiq, F., & ... (2022). Pengaruh Latihan Kekuatan Otot Tungkai terhadap Pukulan Jumping Smash pada Peserta Ekstrakulikuler Bulutangkis Madrasah Tsanawiyah (MTsN) 1 Malang. *Seminar Nasional" Sport*.

U. Usmadi. (2020). Pengujian Persyaratan Analisis (Uji homogenitas dan uji normalitas). *Inovasi Pendidikan*, *7*(1), 50–62.