

EFFECTS OF RESISTANCE BAND EXERCISE ON STUDENT'S FREESTYLE SWIMMING SKILLS

Ilham Ilham¹, David Iqroni¹, Manil Karakauki², Syed Kamaruzaman Syed Ali², Agus Kristiyanto³, Ahmad Nasrulloh⁴, Kukuh Wahyudin Pratama⁵, Rifqi Festiawan⁶, Erick Burhaein⁷ and Diajeng Tyas Pinru Phytanza⁸

¹Department of Physical Education, Faculty of Teacher Training and Education, Universitas Jambi, Indonesia

²Department of Physical Education, Faculty of Education, University of Malaya, Malaysia

³Department of Sport Science, Faculty of Sports, Universitas Sebelas Maret, Indonesia

⁴Department of Sport Science, Faculty of Sport Science, Universitas Negeri Yogyakarta, Indonesia

⁵Institute of Advanced Science, Engineering, and Education (IASEE), Malaysia

⁶Department of Physical Education, Faculty of Health Sciences, Universitas Jenderal Sudirman

⁵Department of Sports Education, Faculty of Teacher Training and Education, Universitas Ma'arif Nahdlatul Ulama Kebumen, Indonesia

⁶Department of Special Education, Faculty of Education, Universitas Negeri Yogyakarta, Indonesia

Original scientific paper

Abstract

This study aims to determine whether resistance band exercise influences freestyle swimming skills in the fourth-semester students of the Faculty of Sports and Health Education Study Program. Resistance band exercises are carried out to bind the strength of the leg, arm, and abdominal muscles because the increased strength in these muscle groups will help in executing freestyle swimming movements properly. This research is an experimental study using the one-group pre-test and post-test design. The research instrument used was a test of freestyle swimming skills at 25 meters, while cross-checking on the observation sheet, the freestyle swimming movements carried out by the subjects studied. This research's hypothesis is that there is an effect of resistance band training on freestyle swimming skills. The results obtained are the value of Sig. (2-tailed) < 0.05 (95% confidence). It can be concluded that there is an effect of resistance band training on the freestyle swimming skills of the for fourth-semester of the Faculty of Sports and Health Education Study Program.

Keywords: Resistance Band, Swimming Skills, Freestyle Swimming

Introduction

Freestyle is a way of swimming that is done with both hands facing down, alternately straightened forward while pedaling and the legs doing flutter kicks up and down alternately; the face is looking at the bottom of the pool, and breathing is done when the elbows are bent and the mouth and/or nose come out of the water (at the surface), the body position is slightly tilted with the head turned to the side or according to the position of the bent hand (Burhaein et al., 2022; Phytanza, Burhaein, Indriawan, et al., 2022; Prasetya, 2021). According to Seifert & Carmigniani (2021) the above-mentioned technique cannot be achieved easily, it is achieved by building strength in the muscles of the arms, abdomen, and legs. Arm muscle strength has a role when straightening the hand while doing the stroke (Jannah et al., 2021; Phytanza, Burhaein, Lourenço, et al., 2022; Widodo & Zainul, 2021). Strength of the abdominal muscles has a role to position the body parallel to the water; specifically, the chest facing the surface of the water and when lifting the arms far forward and taking a breath when the elbows are bent out of the water, with the body tilted and the face turned to the side (Burhaein, Tarigan, Budiana,

Hendrayana, Phytanza, Demirci, et al., 2021; Demirci & Phytanza, 2021; Phytanza, Purwanta, Hermanto, Burhaein, & Lourenço, 2021). Leg muscle strength has a role in making up and down lashes alternately in a straight leg position parallel to the water surface (Pramantik, 2021; P. Purwanto, Nopembri, et al., 2021; Sukendro et al., 2021). The formation of strength in the arms, abdomen, and legs can be done by exercising using a tool called a resistance band. The resistance band material is made of elastic (rubber) that can be used in various ways or variations of movement to form strength in the limbs such as the arms, abdomen legs, and so on (Burhaein, Tarigan, Budiana, Hendrayana, Phytanza, Lourenço, et al., 2021; S. Purwanto & Burhaein, 2021; Sulistianoro & Setyawan, 2021).

According to Keiner et al. (2019), the technique is a skill possessed by a person in carrying out activities. Skills can also be interpreted as a skill or expertise in carrying out certain activities or movements so that in practice there is a movement looks good (beautiful) and the swimmer is able to complete the movement well (Burhaein, Tarigan, Budiana, Hendrayana, Phytanza, Lourenço, et al., 2021; Irawan & Prayoto,

2021; S. Purwanto & Burhaein, 2021). Nikšić et al. (2020) also confirm that the word *skilled* can also be used to indicate success in completing certain tasks well through learning, for example, someone does an exercise or learns leg and arm movements to be able to achieve swimming movements, because this movement is a basic movement in swimming to achieve the goal of being *skilled* at swimming. The term *skilled* can also be used to express the results of a real response to a controlled stimulus (Burhaein, Demirci, Lourenço, Németh, & Phytanza, 2021; Catur & Mujiriah, 2021; P. Purwanto, Lumintuarso, et al., 2021). The response was recorded based on the correct response, frequency, or how fast the reaction occurred. Someone who has done the exercise or learned and then has the proficiency or skill in doing it, shows that there are results from the learned response (Nanda et al., 2021; Phytanza, Purwanta, Hermanto, Burhaein, & Demirci, 2021; Sibarani & Manurung, 2021).

Brackley et al. (2020) emphasize that skills can also describe a person's level of proficiency in completing or carrying out a particular task. Based on the various opinions about skills, we may conclude that skill is a technique, which indicates the expertise of a person in carrying out a movement/activity well, without necessarily incorporating speed (Festiawan et al., 2021; Irawan & Limanto, 2021; Ngadiman et al., 2021). In this case, what we need to understand is that someone can complete the tasks assigned correctly in accordance with the stipulated provisions (Azizah & Sudarto, 2021; Sukendro et al., 2021; Widiyono & Mudiono, 2021). Freestyle is also known as the front crawl. When swimming this stroke, your body will be in a prone position on your stomach and the face is facing downwards partially under the surface of the water. Both the arms and legs will pull through the water, while the torso remains stable (Burhaein, Demirci, Lourenço, Németh, & Phytanza, 2021; Phytanza & Burhaein, 2020; Wang et al., 2020). Executing the freestyle swim is to maintain our face slightly under the water's surface with our eyes continuously looking except when taking a breath with the head positioned sideways while remaining in line with the water surface (Burhaein, Ibrahim, et al., 2020; Nicol et al., 2021; Sutopo & Misno, 2021).

Freestyle swimming is the fastest swimming style of the various swimming styles that are usually done, but a person's admiration when they see people doing freestyle swimming is not from the speed, the strength of the up and down kick that occurs or the distance the swimmer can go based on the strokes made, but they will be amazed by how smooth someone swims and how easy it seems to do the freestyle swim; this is closely related to the swimming skills executed by the swimmer (Burhaein, Tarigan, et al., 2020; Morais et al., 2018; Phytanza & Burhaein, 2019). Resistance bands are sports equipment made of rubber that can be used to add

training loads, to improve physical abilities in the limbs we want such as arms, legs, and abdomen. Apart from that, it can also form flexibility in various parts of the joints and to stretch the muscles in our body parts as well as relax certain body parts that are very instrumental in carrying out movements in various sports (Barbosa et al., 2019).



Figure 1. Resistance Band

Exercises using resistance bands can be done anywhere and, in any situation, it is important to have the desire to activate the limbs (Sutapa et al., 2020). In this case, strength will be formed in the limbs that play a role in freestyle swimming, including the strength of the arms, legs, and abdomen because with the formation of strength in these muscles, it is possible to improve freestyle swimming skills (Kristiyanto et al., 2020). According to Muniz-Pardos et al. (2019), leg muscle strength is very necessary when doing freestyle swimming, especially when swinging the legs regularly, up until the heels are above the water surface and swinging down with the foot position, where this movement must be carried out repeatedly.

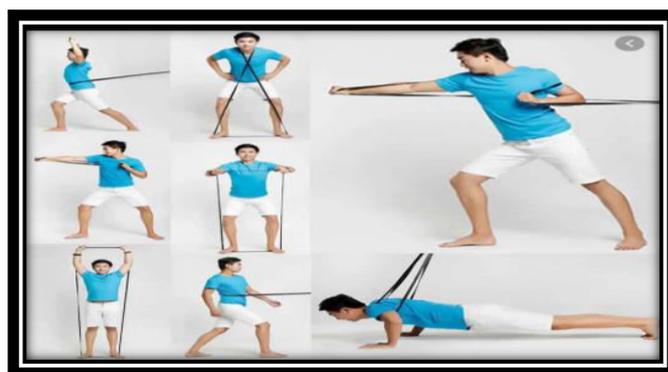


Figure 2. Resistance Band Exercise

The role of arm strength when doing freestyle swimming is when both hands are straight in front of the head, then the stroke is done using one hand, by pulling the hand under the chest, bending the elbow so that the palm is facing backward with the fingers together. Next, straighten the hands until they are parallel to the thighs and the palms are facing up. After that, bending the elbows and lifting them up until they come out of the water surface, then the hands are swung forward near the ears until they are straight ahead and the tips of the fingers first enter the water; this movement is done by both arms

alternately (Aktuđ et al., 2019). Furthermore, according to Nikšić et al. (2020), the role of abdominal muscle strength when doing freestyle swimming is when a swimmer maintains a straight body position above the water surface while moving the legs alternately up and down (freestyle leg movements), and when doing the stroke, starts from the hands straight in front of the head then pulls the palms down to the chest, continues to straighten the back until it is parallel to the thighs, then bends the elbows until they come out of the water surface, then straighten the hands forward through the ears until the fingers enter the water; this is done in coordination between hand, foot and breath movements.

The body parts that play a role in freestyle swimming whose strength will be formed in this study through resistance band training are the arms, legs, and abdomen, which used freestyle swimming skills. Based on the description above, it can be described as a conceptual framework of thinking as follows:



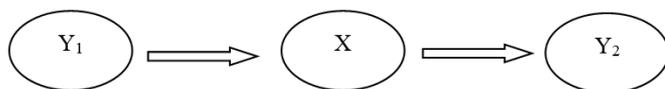
Figure 3. Conceptual Framework

The remaining of this paper is organized as follows. Section 2 reviews all materials and methods. Section 3 presents the result. Section 4 presents the discussion about this study and finally, Section 5 concludes with some direction for future work.

Methods

Research Methods

This research is experimental research, where treatment is carried out on the independent variable to influence the dependent variable (Fraenkel et al., 2012). Experimental research can be interpreted as a research method used to find the effect of certain treatments on others. This study used the one group pre-test-post-test design, as follows:



Description: Y₁=Pre-test; X=treatment; Y₂=Post-test
Figure 4. Research Design

Participants

The population of this research is all students of the Faculty of Sports and Health Education Study Program, Jambi University, in the fourth semester, classes A and B. While the sample is all students in classes A and B totaling 75 students.

The research was carried out at the Telago Ratu swimming pool, Jambi City for 18 sessions, including the implementation of the pre-test and the post-test. Prior to the pre-test, the instrument used to collect data on freestyle swimming skills were tested, and validity and reliability were tested.

Instruments

The instrument used to collect freestyle swimming skill data in this study was a freestyle swimming skill test using an observation sheet, which contained the freestyle swimming coordination movement technique that had been tested for validity and reliability. This instrument was used for the initial test and the final test. To obtain the data in this study, a freestyle swimming test with 25 meters was carried out while cross-checking the movements made by the subject (sample) with the prepared freestyle swimming skill observation sheet; this was carried out on the initial test and the final test. The way the test is carried out is as follows:

1. The test taker (sample) stands in the pool to get ready on the edge of the pool facing the pool (swimming direction).
2. On the signal YES, the test-taker (sample) started to push using both feet against the pool wall and then perform a coordinated freestyle swimming.
3. The observer observes the technique or freestyle swimming skill carried out by the test-taker (sample) while cross-checking the observation sheet provided and putting a check mark (√) in the column that has been prepared on the observation sheet that corresponds to the movement made by the test-taker (sample).

Each movement by the test-taker (sample), that is in accordance with the observation sheet made is given a checkmark (√); is given a score of 1 (one) if it is not appropriate or given a score of 0 (zero).

Results

Data Description

Based on the results of research on the effect of resistance band training on freestyle swimming skills, Faculty of Sports and Health Education Study Program, Jambi University, in the fourth semester, classes A and B with a total sample of 75 people, from the results of the pre-test and post-test, the freestyle swimming skills on the pre-test obtained an average of 14.72, a standard deviation of 2.38, the best skill with a score of 21, the lowest skill with a score of 10, and a range of 11. Table 1 below is a description of the data on freestyle swimming skills.

Table 1. Description of Freestyle Swimming Skills. Expert validation results.

Description	Pre-test	Post-test
Mean	14.72	28,48
Median	15	29
Mode	15	30
Standard Deviation	2.38	1.54
Range	11	6
Minimum	10	24
Maximum	21	30
Sum	1148	2136
Largest	21	30
Smallest	10	24
Confidence Level (95,0%)	0.54	0,35

Pre-test Group Freestyle Swimming Skills

Based on table 2 above, the distribution of data from the pre-test results with a total sample of 75 obtained 4 samples. (5%) obtained a skill score of 19

- 24 and were in Good Criteria, 57 samples (76%) obtained a freestyle swimming skill score of 13 - 18 are on the Medium Criterion and 14 samples (19%) get a skill score of 7 - 12 are on the Less Criteria.

Table 2. Frequency Distribution of Differences in Freestyle Swimming Skills Pre-test Results.

No	Interval Class	Fa	Fr	Criteria
1.	25 - 30	0	0%	Very good
2.	19 - 24	4	5%	Good
3.	13 - 18	57	76%	Enough
4.	7 - 12	14	19%	Not enough
5.	0 - 6	0	0%	Less
Total		75	100%	

Freestyle Swimming Skills Post - test Group

Based on the distribution of data from the post test results with a total sample of 75, 74 samples (99%) obtained a freestyle swimming skill score of 25 - 30

were in Excellent Criteria, and 1 sample (1%) obtained a skill score of 19 - 24 was on Good Criteria.

Table 3. Frequency Distribution of Post-test Data Freestyle Swimming Skills.

No	Score	Fa	Fr	Criteria
1.	25 - 30	74	99%	Very good
2.	19 - 24	1	1%	Good
3.	13 - 18	0	0%	Enough
4.	7 - 12	0	0%	Not enough
5.	0 - 6	0	0%	Less
Total		75	100%	

Normality test

Based on the results of the Kolmogorov-Smirnov analysis using SPSS, the results of the normality test can be said to be normally distributed if the sig. (2-tailed) (.321 for pre-test and .113 for post-test) > 0.05 and based on the table the results of the

analysis mean that the freestyle swimming skills of Faculty of Sports and Health Education Study Program, Jambi University, in the fourth semester, classes A and B are normally distributed.

Table 4. Normality Test Results Freestyle Swimming Skills Test.

Activity		Pre Test	Post Test
N		75	75
Normal Parameter	Mean	14.72	28.48

a,b	Std. Deviation	2.379	1.537
Most Extreme Differences	Absolute	.132	.199
	Positive	.132	.161
	Negative	-.096	-.199
Statistic		.132	.199
Asymp. Sig (2-tailed)		.321 ^c	.113 ^c

- a. Test distribution is Normal
- b. Calculated from data
- c. Lilliefors Significance Correction

Homogeneity test

The homogeneity test of variance used the lavene test with the data criteria declared homogeneous if the value of Sig. (2-tailed) > 0.05. Based on the analysis of the lavene test, the sig. value was obtained. (2-tailed) = 0.053 > 0.005 thus it can be stated that the initial and final test data for freestyle swimming skills come from a homogeneous population.

Based on the table of homogeneity test analysis results using the lavene test using the SPSS application, the data for the pre-test and post-test of freestyle swimming skills are Faculty of Sports and Health Education Study Program, Jambi University, in the fourth semester, class A and B, coming from a homogeneous population because of the Sig value. (2-tailed) = 0.053 > 0.05.

Table 5. Freestyle Swimming Skills Homogeneity Test Results.

Freestyle Swimming Skills Test Results			
Leven Statistic	Df 1	Df 2	Sig
12.173	1	151	.053

Hypothesis testing

The hypothesis test used in this research is the independent sample test. Decision-making criteria if Sig. (2-tailed) < 0.05, then Ha is accepted, meaning that there is an effect of resistance band training on freestyle swimming skills provided that there are significant differences in the data. The results of data analysis obtained a significant value of Sig. (2-tailed) probability value/p value Paired T-test: Result =

0.000. Meaning that there is a difference between before and after treatment. Cause: Sig. (2-tailed) < 0.05 (95% confidence). The explanation of the results of the data analysis can be seen in the following Table 6. From the results obtained, there is an effect of resistance band training on the freestyle swimming skills which is shown in the table of analysis results, where the value of Sig. (2-tailed) = .000 < 0.05.

Table 6. Freestyle Swimming Skills ANOVA Test Results

	Sum of Squares	Df	Mean Square	F	Sig
Between	7241.537	1	7241.537	1791.066	.000
Within Group	610.515	151	4.043		
Total	7852.052	152			

Discussions

For clarity in this section of the discussion, the results of research data on the effect of resistance band training on freestyle swimming skills is based on the number of samples in the initial test and final test, totalling 75 students. From the pre-test and post-test results obtained by students in the initial test, the average calculation is 14.72, standard deviation is 2.38, the best skill with a score of 21, the lowest skill with a score of 10, and a range of 11. Meanwhile, in the post-test, it was indicated that an average calculation of 28.48 standard deviations was 1.54, the best skill score was 30, the lowest skill score was 24, and the range was 6. This shows that there are differences in the results of the pre-test and post-test.

In the normality test with the Kolmogorov Smirnov test, on the analysis of the data above, it can be concluded that the initial test data and the student's overall test, t are declared to be normally distributed. Then, in the homogeneity test of variance with Levene's test, the sig value was obtained = 0.053 > 0.05, it can be stated that the initial and final test data for freestyle swimming skills come from a homogeneous population. And lastly, for the results of hypothesis testing, a significant value of Sig. (2-tailed): Value of Sig. (2-tailed). Meaning: There is a difference between before and after treatment. Cause: Sig. (2-tailed) < 0.05 (95% confidence).

This shows that there is an effect of resistance band training on the freestyle swimming skills of the

Faculty of Sports and Health Education Study Program, Jambi University, in the fourth semester, classes A and B. Among the studies that have proven successful in using exercises with resistance bands are Batalha et al. (2018) and Morais et al. (2018), in these studies, training using resistance bands greatly affects muscles and strength in freestyle swimming movements. Apart from that it is further explained by Ravé et al. (2018), that swimming is a sport that combines several factors such as a high level of muscle strength, technical skills, coordination, rhythm, speed, explosive power, and correct technique which requires appropriate training tools. Swimming can be done by anyone if they have the ability and good mastery of technique (Saifu et al., 2021). Good mastery of technique in swimming includes the ability to move hands and feet as well as good breathing. Freestyle is an example of a style that requires good coordination between the limbs, hence forth, good skills are needed to do freestyle swimming (Alagöz et al., 2021).

Freestyle also requires good technique and body position. The position of the body in doing freestyle swimming must be parallel to the surface of the water. The position of the body is prone to the water in a floating position. The muscles of the body must be relaxed when carrying out propulsion movements or when sliding through the water. In addition, the movement of the legs in freestyle swimming is attained by raising and lowering both legs alternately with hand movements, in a motion of swinging both hands forward in turn. If one hand is in front of the body, the other hand is behind the body and the little finger touches the surface of the water first, when in the motion of swinging the hand. While one hand is swinging, then the other hand must be in a straight position, parallel to the surface of the water. Then breathing in freestyle swimming is done with the body position tilted to the side with the eyes focused on the surface of the water. The position of the face is in the water and the position of the mouth is at, or just out of the water surface (Gönener et al., 2017).

Mastering freestyle swimming cannot be done in a short time, one must go through a long and focused training process. The importance of mastering swimming skills in freestyle swimming was expressed by Crowley et al. (2017); that the perfection of the skill of each swimming movement is important because it will determine the overall movement. Therefore, every form of movement skill needed in every sport must be trained and mastered perfectly in a learning and training process.

Freestyle swimming is a sport that requires coordination between arm movements, leg movements, and when you take a breath, meaning that when you take a breath your head is only slightly out of the water, therefore you really need fast and precise arm movements. For the arm to move properly, it takes practice to select the appropriate exercise equipment. In this study, training using a resistance band proved to be very helpful in improving freestyle swimming skills. This exercise has proven to be effective in improving skills in freestyle swimming.

Conclusion

Based on the data analysis and discussion in the previous section of this research, it can be concluded that there is an effect of resistance band training on the improvement of freestyle swimming skills at the Faculty of Sports and Health Education Study Program, Jambi University, in the fourth semester, class A and B in the Fourth Semester. The above is indicated by the results of the hypothesis test obtained, namely the significant value of Sig. (2-tailed): Probability value/p value Paired T-test: Result = 0.000. Meaning: There is a difference between before and after treatment. With p-value < 0.05 (95% confidence). Exercises with resistance bands are proven and have a good effect on improving freestyle swimming. In the future, studies can be carried out on other swimming styles with even more specific requirements, using other equipment. Future research is needed with respect to the effects of long-term resistance-training interventions on both technical parameters of swimming and overall swimming performance. The results of such work will be highly informative for the scientific community, coaches and athletes.

Acknowledgments

This research is supported by Jambi University (Indonesia), University of Malaya (Malaysia), Universitas Negeri Yogyakarta (Indonesia), Institute of Advanced Science, Engineering, and Education (IASEE), Malaysia, Universitas Garut (Indonesia), and Universitas Ma'arif Nahdlatul Ulama Kebumen (Indonesia).

Conflict of Interests

Researchers said there was no conflict of interest in the study. Researchers said there was no conflict of interest in the study.

References

- Aktuğ, Z. B., Vural, Ş., & Ibis, S. (2019). The Effect of Theraband Exercises on Motor Performance and Swimming Degree of Young Swimmers1. *Turkish Journal of Sport and Exercise*, 21(2), 238–243. <https://doi.org/10.15314/tsed.578524>
- Alagöz, İ., Can, S., Demirkan, E., Özkadı, T., & Demir, E. (2021). Effect of different training models on motoric and swimming performance in prepubescent swimmers. *Pedagogy of Physical Culture and Sports*, 25(5), 286–295. <https://doi.org/10.15561/26649837.2021.0503>
- Azizah, A. R., & Sudarto, E. P. (2021). Minat Mengikuti Ekstrakurikuler Bola Voli Siswa Smp Negeri 3 Satu Atap Karangasambung Kecamatan Karangasambung Tahun Ajaran 2019/2020. *JUMORA: Jurnal Moderasi Olahraga*, 1(01), 35–44. <https://doi.org/10.53863/mor.v1i01.132>
- Barbosa, T. M., Bartolomeu, R., Morais, J. E., & Costa, M. J. (2019). Skillful swimming in age-groups is determined by

- anthropometrics, biomechanics and energetics. *Frontiers in Physiology*, 10(73), 1–10. <https://doi.org/10.3389/fphys.2019.00073>
- Batalha, N., Dias, S., Marinho, D. A., & Parraca, J. A. (2018). The Effectiveness of Land and Water Based Resistance Training on Shoulder Rotator Cuff Strength and Balance of Youth Swimmers. *Journal of Human Kinetics*, 62(1), 91–102. <https://doi.org/10.1515/hukin-2017-0161>
- Brackley, V., Barris, S., Tor, E., & Farrow, D. (2020). Coaches' perspective towards skill acquisition in swimming: What practice approaches are typically applied in training? *Journal of Sports Sciences*, 38(22), 2532–2542. <https://doi.org/10.1080/02640414.2020.1792703>
- Burhaein, E., Demirci, N., Lourenço, C. C. V., Németh, Z., & Phytanza, D. T. P. (2021). Coping with the COVID-19 pandemic: the role of physical activity. An international position statement. *International Sports Studies*, 43(1), 52–70. <https://doi.org/10.30819/iss.43-1.05>
- Burhaein, E., Ibrahim, B. K., & Pavlovic, R. (2020). The Relationship of Limb Muscle Power, Balance, and Coordination with Instep Shooting Ability: A Correlation Study in Under-18 Football Athletes. *International Journal of Human Movement and Sports Sciences*, 8(5), 265–270. <https://doi.org/10.13189/saj.2020.080515>
- Burhaein, E., Tarigan, B., Budiana, D., Hendrayana, Y., & Phytanza, D. T. P. (2022). Profile of changes in adaptive physical education learning during the Covid-19 pandemic. In *Innovation on Education and Social Sciences* (1st ed., pp. 19–28). Routledge. <https://doi.org/10.1201/9781003265061-3>
- Burhaein, E., Tarigan, B., Budiana, D., Hendrayana, Y., Phytanza, D. T. P., Demirci, N., Fradelos, E. C., Lourenço, C., & Nikšić, E. (2021). Instrument Physical Activity Questionnaire-Disability (IPAQ-D) Observe Test for Disability during COVID-19: Study of Validity and Reliability in 5 Countries. *Sport Science*, 15(1), 13–20. <http://www.sposci.com/PDFS/BR1501/04 CL 02 EB.pdf>
- Burhaein, E., Tarigan, B., Budiana, D., Hendrayana, Y., Phytanza, D. T. P., Lourenço, C., Permana, D., & Nuruldani, G. (2021). Dimensions in The Learning Implementation and Strategies of Adapted Physical Education for Children with Special Needs during The COVID-19 Pandemic: A Literature Review & Grounded Theory. *Sport Science*, 15(1), 189–201.
- Burhaein, E., Tarigan, B., & Phytanza, D. T. P. (2020). The experience and understanding of the K-13 curriculum implementation of Indonesian teachers of Adapted Physical Education (APE). *International Sports Studies*, 42(e), 29–42. <https://doi.org/10.30819/iss.42-e.04>
- Catur, D., & Mujiriah, B. (2021). Survey of Physical Fitness Levels of Badminton Athletes in Binjai City , Indonesia. *JUMORA: Jurnal Moderasi Olahraga*, 1(2), 84–94. <https://doi.org/10.53863/mor.v1i02.228>
- Crowley, E., Harrison, A. J., & Lyons, M. (2017). The Impact of Resistance Training on Swimming Performance: A Systematic Review. *Sports Medicine*, 47(11), 2285–2307. <https://doi.org/10.1007/s40279-017-0730-2>
- Demirci, N., & Phytanza, P. D. T. (2021). Investigation of Obesity, Physical Activity and Sedentary Behaviors of Individuals with and Without Autism Spectrum Disorder during the Covid-19 Pandemic Process. *JUMORA: Jurnal Moderasi Olahraga*, 1(02), 45–55. <https://doi.org/10.53863/mor.v1i02.220>
- Festiawan, R., Hooi, L. B., Nor, M. A. M., Ngadiman, N., Widiawati, P., Burhaein, E., & Phytanza, D. T. P. (2021). Traditional Sports-Based Learning: Innovative Learning Method to Improve Fundamental Movement Skills and Learning Motivation. *Sport Science*, 15(1).
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education*. Mc Graw Hill.
- Gönener, A., Gönener, U., Yılmaz, O., Horoz, T., & Demirci, D. (2017). The effect of 8-week thera-band exercises on male swimmers' 100 m freestyle swimming performance. *Journal of Human Sciences*, 14(4), 3950. <https://doi.org/10.14687/jhs.v14i4.4825>
- Irawan, Y. F., & Limanto, D. (2021). Pengaruh Kecerdasan Emosi dan Kesiapan Diri Terhadap Pertandingan Pada Pemain Walet Muda Futsal Academy Kebumen Tahun 2020. *JUMORA: Jurnal Moderasi Olahraga*, 1(01), 18–26. <https://doi.org/10.53863/mor.v1i01.130>
- Irawan, Y. F., & Prayoto, I. (2021). Survey of Basic Technical Skill for Futsal Male Student High School. *JUMORA: Jurnal Moderasi Olahraga*, 1(2), 105–114. <https://doi.org/10.53863/mor.v1i02.246>
- Jannah, A. M., Kushartanti, B. W., Rahman, A., Burhaein, E., & Phytanza, D. T. P. (2021). Development of Hockey Game-Basef Recovery Model. *Sport Science*, 15(1).
- Keiner, M., Wirth, K., Fuhrmann, S., Kunz, M., Hartmann, H., & Haff, G. G. (2019). The Influence of Upper- and Lower-Body Maximum Strength on Swim Block Start, Turn, and Overall Swim Performance in Sprint Swimming. *Journal of Strength and Conditioning Research*, 35(10), 2839–2845. <https://doi.org/10.1519/jsc.0000000000003229>
- Kristiyanto, A., Prasetyo, Y., Pratama, K. W., Karakauki, M., Mustapha, A., & Idrus, S. Z. S. (2020). Access to the Utilization of Science and Technology of Sports and Familiarity of the Sports Community towards Technologically Based Devices. *Journal of Physics: Conference Series*, 1529(2), 1–9. <https://doi.org/10.1088/1742-6596/1529/2/022099>
- Morais, J. E., Silva, A. J., Garrido, N. D., Marinho, D. A., & Barbosa, T. M. (2018). The transfer of strength and power into the stroke biomechanics of young swimmers over a 34-week period. *European Journal of Sport Science*, 18(6), 787–795. <https://doi.org/10.1080/17461391.2018.1453869>
- Muniz-Pardos, B., Gomez-Bruton, A., Matute-Llorente, A., Gonzalez-Aguero, A., Gomez-Cabello, A., Gonzalo-Skok, O., Casajus, J. A., & Vicente-Rodriguez, G. (2019). Swim-specific resistance training. *Journal of Strength and Conditioning Research*, 33(10), 2875–2881. <http://journals.lww.com/00124278-201910000-00031>
- Nanda, F. A., Novriansyah, N., Nugroho, M. D., Fajaruddin, S., Utama, M. B. R., Burhaein, E., & Phytanza, D. T. P. (2021). Psychological Skills of Basketball Athletes by Perspektif Gender: Study Indonesian Athletes in Asian Games XVIII. *Sport Science*, 15(1).
- Ngadiman, N., Festiawan, R., Wahono, B. S., Purnamasari, A. D., Burhaein, E., & Phytanza, D. T. P. (2021). The Motor Skills Test for New Students of Physical Education Program. *Sport Science*, 15(1).
- Nicol, E., Ball, K., & Tor, E. (2021). The biomechanics of freestyle and butterfly turn technique in elite swimmers. *Sports Biomechanics*, 20(4), 444–457. <https://doi.org/10.1080/14763141.2018.1561930>
- Nikšić, E., Beganović, E., Joksimović, M., & Mušović, A. (2020). The Influence of Balance and Flexibility on the Performance of Freestyle Swimming. *Journal of Physical Education and Sports Studies*, 12(2), 59–64. <https://doi.org/10.30655/besad.2020.27>
- Phytanza, D. T. P., & Burhaein, E. (2019). Aquatic activities as play therapy children autism spectrum disorder.

- International Journal of Disabilities Sports and Health Sciences*, 2(2), 64–71. <https://doi.org/10.33438/ijdschs.652086>
- Phytanza, D. T. P., & Burhaein, E. (2020). The Effects of Tenure, Teacher Certification, and Work Motivation on Special Needs Teacher Performance. *Universal Journal of Educational Research*, 8(9), 4348–4356. <https://doi.org/10.13189/ujer.2020.080962>
- Phytanza, D. T. P., Burhaein, E., Indriawan, S., Lourenço, C. C. V., Demirci, N., Widodo, P., Widiyono, I. P., Irawan, Y. F., Sutopo, W. G., Parmadi, M., Azizah, A. R., Saleh, M., Hadiatmo, A., & Susanto, A. (2022). Accuracy Training Program: Can Improve Shooting Results of Petanque Athletes Aged 15-20 Years? *International Journal of Human Movement and Sports Sciences*, 10(1), 121–130. <https://doi.org/10.13189/saj.2022.100117>
- Phytanza, D. T. P., Burhaein, E., Lourenço, C. C. V., Budiman, B., Yusuf, J., Kinasih, A., Gandasari, M. F., & Taroreh, B. S. (2022). Nutritional Status of Children Aged 6-17 Years: The Condition during the COVID-19 Pandemic Reviewing Weight Indexed by Height. *Universal Journal of Public Health*, 10(2), 159–167. <https://doi.org/10.13189/ujph.2022.100202>
- Phytanza, D. T. P., Purwanta, E., Hermanto, H., Burhaein, E., & Demirci, N. (2021). Floortime Approach: Can It Improve The Learning Outcomes of Side-Rolling Exercises for Autism Spectrum Disorder Students? *Sport Science*, 15(1), 141–151. http://www.sposci.com/PDFS/BR1501/19.OriginalArticle_Phytanza,et_al_SportScience.pdf
- Phytanza, D. T. P., Purwanta, E., Hermanto, H., Burhaein, E., & Lourenço, C. C. V. (2021). Level Of Physical Activity of Students With Autism Spectrum Disorders during The COVID-19 Pandemic. *Sport Science*, 15(1), 152–157. http://www.sposci.com/PDFS/BR1501/20.OriginalArticle_Phytanza,et_al_SportScience.pdf
- Pramantik, I. A. D. (2021). Optimization of Gobak Sodor Based Neuroscience Learning Game as Character Education in Intellectual Disabilities. *JUMORA: Jurnal Moderasi Olahraga*, 1(02), 63–74. <https://doi.org/10.53863/mor.v1i02.231>
- Prasetya, M. R. A. (2021). Comparison Of Achievement Sport Systems Between Indonesia And China. *JUMORA: Jurnal Moderasi Olahraga*, 1(2), 56–62. <https://doi.org/10.53863/mor.v1i02.213>
- Purwanto, P., Lumintuarso, R., & Burhaein, E. (2021). Impact of Running Techniques through the Sprint Ability in Athletes during the COVID-19 Pandemic. *International Journal of Human Movement and Sports Sciences*, 9(4), 717–724. <https://doi.org/10.13189/saj.2021.090416>
- Purwanto, P., Nopembri, S., Burhaein, E., & Phytanza, D. T. P. (2021). Evaluation of The Venue Management Program of The National Sports Week (PON) XVII of Riau Province, Indonesia. *Sport Science*, 15(1), 86–96. <http://www.sposci.com/PDFS/BR1501/04.CL13.PP.pdf>
- Purwanto, S., & Burhaein, E. (2021). The Sports Development Program at the Indonesia Karate Sport Federation (FORKI) in The DIY Province of Indonesia. *Sport Science*, 15(1), 77–85. <http://www.sposci.com/PDFS/BR1501/04.CL12.SP.pdf>
- Ravé, J. M. G., Lega-Rrese, A., González-Mohino, F., Yustres, I., Barragán, R., De Asís Fernández, F., Juárez, D., & Arroyo-Toledo, J. J. (2018). The Effects of Two Different Resisted Swim Training Load Protocols on Swimming Strength and Performance. *Journal of Human Kinetics*, 64(1), 195–204. <https://doi.org/10.1515/hukin-2017-0194>
- Saifu, Karakauki, M., Ali, S. K. S., Mustapha, A., Muslim, B. A., Ismiyati, F., Sundara, C., Wahyuni, S., Putri, D. T., Kristiyanto, A., Pratama, K. W., Nasrulloh, A., & Yudhistira, D. (2021). The effect of small game exercise on freestyle swimming speed: A case study of Halu Oleo university sport science student. *International Journal of Human Movement and Sports Sciences*, 9(6), 1140–1145. <https://doi.org/10.13189/saj.2021.090609>
- Seifert, L., & Carmigniani, R. (2021). Coordination and stroking parameters in the four swimming techniques: a narrative review. *Sports Biomechanics*, Aug 9, 1–17. <https://doi.org/10.1080/14763141.2021.1959945>
- Sibarani, M. A., & Manurung, J. S. R. (2021). Difference in The Influence of Practice Regulating Passes and Regulating The Game Against The Accuracy of Passing in Junior Football Players. *JUMORA: Jurnal Moderasi Olahraga*, 1(2), 75–83. <https://doi.org/10.53863/mor.v1i02.227>
- Sukendro, S., Karakauki, M., Ali, S. K. S., Kristiyanto, A., Pratama, K. W., Nasrulloh, A., Festiawan, R., Burhaein, E., & Phytanza, D. T. P. (2021). THE RELATIONSHIP BETWEEN NUTRITIONAL STATUS AND PHYSICAL HEALTH LEVELS OF STUDENTS AT THE MODERN ISLAMIC BOARDING SCHOOL. *Sport Science*, 15(1).
- Sulistiantoro, D., & Setyawan, F. B. (2021). Physical Education Textbook Study : Techniques and Forms of Assessment of Knowledge and Skills of Middle School Students in Indonesia. *JUMORA: Jurnal Moderasi Olahraga*, 1(2), 95–104. <https://doi.org/10.53863/mor.v1i02.236>
- Sutapa, P., Prasetyo, Y., Pratama, K. W., Karakauki, M., Mustapha, A., Idrus, S. Z. S., & Sutapa, P. (2020). Motor Development Index (MDI) Based on Combination of Human Development Index (HDI) and Sport Development Index (SDI) as a Success Parameter of Motor Development among Preschool Children: An Observational Study. *Journal of Physics: Conference Series*, 1529(3), 1–9. <https://doi.org/10.1088/1742-6596/1529/3/032003>
- Sutopo, W. G., & Misno. (2021). Analisis Kecepatan Tendangan Sabit Pada Pesilat Remaja Perguruan Pencak Silat Tri Guna Sakti Di Kabupaten Kebumen Tahun 2020. *JUMORA: Jurnal Moderasi Olahraga*, 1(01), 27–34. <https://doi.org/10.53863/mor.v1i01.131>
- Wang, J., Wang, Z., Member, S., Gao, F., Zhao, H., Qiu, S., & Li, J. (2020). Swimming Stroke Phase Segmentation Based on Wearable Motion Capture Technique. *IEEE Transactions on Instrumentation and Measurement*, 69(10), 1–12.
- Widiyono, I. P., & Mudiono. (2021). Keterampilan Dasar Futsal Peserta Ektrakurikuler di SMK Ma'arif 1 Kebumen Tahun Ajaran 2019/2020. *JUMORA: Jurnal Moderasi Olahraga*, 1(01), 10–17. <https://doi.org/10.53863/mor.v1i01.129>
- Widodo, P., & Zainul, F. (2021). Basic Swimming Style Crawl Engineering Skills Survey in Athletes Ages 10-12. *JUMORA: Jurnal Moderasi Olahraga*, 1(2), 115–124. <https://doi.org/10.53863/mor.v1i02.285>

Received: 20 May 2021

Accepted: 20 December 2021

Corresponding author:

Erick Burhaein

Department of Sports Education, Faculty of Teacher Training and Education,
Universitas Ma'arif Nahdlatul Ulama Kebumen, Indonesia

E-mail: erick.burhaein@umnu.ac.id