

# fizjoterapia polska

POLISH JOURNAL OF PHYSIOTHERAPY

OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII

THE OFFICIAL JOURNAL OF THE POLISH SOCIETY OF PHYSIOTHERAPY

NR 3/2023 (23) KWARTALNIK ISSN 1642-0136



**Występowanie  
zaburzeń w obrębie stawów skroniowo-  
żuchwowych podczas zarażenia COVID-19**  
**The occurrence of temporomandibular  
joint disorders during COVID-19  
infection**

**Possibilities of physiotherapeutic treatment in the case of patients with pusher syndrome**

**Możliwości postępowania fizjoterapeutycznego u pacjentów z zespołem odpychania**

**ZAMÓW PRENUMERATĘ!**

**SUBSCRIBE!**

[www.fizjoterapiapolska.pl](http://www.fizjoterapiapolska.pl)

[www.djstudio.shop.pl](http://www.djstudio.shop.pl)

[prenumerata@fizjoterapiapolska.pl](mailto:prenumerata@fizjoterapiapolska.pl)



# The effect of circuit training program on physical fitness level in volleyball club athletes IPK Kuamang

*Efekt programu treningu obwodowego na poziom kondycji fizycznej zawodników klubu siatkówki IPK Kuamang*

Jihan Faira Zanada<sup>1(A,B,C,D)</sup>, Ahmad Nasrulloh<sup>1(C,D,E,F)</sup>, Sigit Nugroho<sup>1(D,E,F,G)</sup>,  
Nugroho Susanto<sup>2(C,E,F,G)</sup>

<sup>1</sup>Yogyakarta State University, Indonesia

<sup>2</sup>Padang State University, Indonesia

## Abstract

The aim of the study is to determine how circuit training affects the fitness of volleyball players. This research employs an experimental approach using a "one-group pretest-posttest design". The research instrument is the TKJI (Indonesian Physical Freshness Test) tailored for the age group of 16-19 years. The study population comprises volleyball players from the IPK Kuamang club, with a total of 20 individuals. Sampling was conducted using a targeted sampling technique, and the sample consisted of 10 individuals. Data analysis was carried out using the Liliefors normality test and t-test with a significance level of  $\alpha = 0.05$ . The results indicated a significant effect of circuit training on physical fitness, as evidenced by an average pre-test score of 12.3 and an average post-test score of 15.2. This conclusion is supported by the finding that  $t_{\text{count}} = 13.1 > t_{\text{table}} = 1.833$  after completing the t-test. Therefore,  $H_0$  is rejected, and  $H_1$  is accepted. Hence, circuit training significantly impacts physical fitness.

## Keywords

circuit training, physical fitness, volleyball

## Streszczenie

Celem badania jest ustalenie, jak trening obwodowy wpływa na kondycję fizyczną siatkarzy. Badanie to opiera się na eksperymentalnym podejściu przy użyciu schematu "badanie przedtestowe - badanie potestowe dla jednej grupy". Narzędziem badawczym jest TKJI (Indonezyjski Test Świeżości Fizycznej) dostosowany dla grupy wiekowej 16-19 lat. Populacja badana obejmuje siatkarzy z klubu IPK Kuamang, w liczbie 20 osób. Wybór próby był przeprowadzony przy użyciu celowej techniki próbkowania, a próbka składała się z 10 osób. Analiza danych była przeprowadzona przy użyciu testu normalności Lilieforsa oraz t-testu z poziomem istotności  $\alpha = 0,05$ . Wyniki wskazują na znaczący wpływ treningu obwodowego na kondycję fizyczną, co potwierdza średnia wyników przedtestowych na poziomie 12,3 i średnia wyników potestowych na poziomie 15,2. Wniosek ten jest wspierany przez ustalenie, że  $t_{\text{count}} = 13,1 > t_{\text{table}} = 1,833$  po zakończeniu t-testu. Dlatego  $H_0$  jest odrzucana, a  $H_1$  jest akceptowana. Zatem trening obwodowy ma istotny wpływ na kondycję fizyczną.

## Słowa kluczowe

trening obwodowy, kondycja fizyczna, siatkówka

**Introduction**

Volleyball is a sport in which players aim to send the ball over a net, seeking to land it in the opponent’s court to secure a win [1]. As a team sport, volleyball involves intricate movements and necessitates considerable skill [2]. It's not only popular but also fun, intriguing, and affordable [3]. Playing volleyball can boost endurance and foster a sense of joy. Aligning these activities with overarching goals for physical pursuits that engender a positive atmosphere is beneficial for health. Volleyball demands significant physical, technical, and mental prowess during gameplay [4]. Thus, peak physical condition is paramount for optimal performance. Enhancing physical fitness entails a thorough and systematic exercise regimen aimed at bolstering strength and the body's functional capacity, ultimately enhancing the athlete’s performance. At its core, an athlete’s physical condition is a facet of biomotor performance [5]. Physical prowess encompasses endurance, strength, explosive power, speed, flexibility, agility, balance, coordination, and both aerobic and anaerobic metabolic processes [6]. Athletes need to adequately develop these abilities to excel in their chosen sport [7].

Physical development is pivotal in sports [8], a sentiment echoed by studies which suggest that "physical freshness pertains to one's capability to execute daily activities energetically, efficiently, and over extended periods without significant fatigue, while retaining energy for additional tasks" [9]. Physical exercise, integral to health, warrants attention [10]. All aspects must be nurtured and developed in unison, ensuring the individual's holistic growth, fostering a productive and competitive spirit. Physical fitness reflects an individual's capacity to work effectively without tiring. It represents the body's adaptability in daily activities without inducing excessive fatigue [11]. Fitness encapsulates the benefits of daily exercises without undue fatigue [12]. It's a blend of genetic predisposition and consistent exercise, illustrating an individual's ability for aerobic activities, endurance, strength, and flexibility [13]. Strong muscles safeguard bones, organs, and joints, enhancing strength, energy, endurance, and injury resistance [14]. Physical strength has numerous advantages, such as fostering flexibility and promoting cardiopulmonary function. Effective engagement in various activities necessitates physical fitness [15]. Achieving this requires exercises encompassing physical fitness elements with proper techniques, either individually tailored or sourced from volleyball clubs.

IPK Kuamang, founded in 2018 in Ujung Gading, West Pasaman Regency, is a men's volleyball club. They actively participate in inter-regional tournaments in West Pasaman Regency, often securing second place, narrowly missing the top spot. Observations and insights from IPK Kuamang's coach revealed concerns about the athletes' physical fitness. The existing training, a mere 10-15 minute run, is inadequate, causing players to avoid physical training in favor of technical and strategic sessions. This can be attributed to monotonous training methods, exhausting preparatory routines, and ineffective programs [16, 17]. Optimal results hinge on the athlete’s physical readiness and the nature of training. Circuit training, characterized by a series of varied exercises with brief intervals, can be the answer.

Circuit training comprises a gamut of integrated exercises with interspersed rest periods. It entails a series of resistance exercises executed successively with minimal breaks, promoting improved body composition, strength, and endurance [18]. Circuit training, ranging from 4-12 stations [20], is economical and varied, reducing monotony. It's known to enhance health-related fitness [21, 22], boosting strength, muscular endurance, flexibility, cardiovascular health, and overall body composition [23, 24]. Its design considers principles, load variations, and player attributes [25], aiming for autonomy, engagement, and self-determination. Circuit training also encourages mutual respect, offering myriad educational benefits, including valuing diverse skills equally [26].

Given these considerations, this research examines the "effect of a circuit training program on physical fitness levels in IPK Kuamang club volleyball players."

**Method**

The study employs a “one-group pretest-posttest design”. The research instrument, the TKJI (Indonesian Physical Freshness Test), gauges physical fitness. Purposive sampling is adopted with a sample size of 10 from a population of 20 IPK Kuamang volleyball players aged 16-19. Data analysis techniques include a normality test and a t-test with a significance level of 0.05.

**Result**

**Physical fitness pre-test**

The physical fitness pretest results had an average score of 12.3 with a standard deviation of 2.35. The scores ranged from 9 to 16, as detailed in the frequency distribution table below:

**Table 1. Frequency distribution of physical fitness pre-test results**

No	Number of values	Category	Frequency	
			Absolute (Fa)	Relative
1	22-25	Very Good (BS)	0	0%
2	18-21	Good (B)	0	0%
3	14-17	Medium (S)	3	30%
4	10-13	Less than medium (K)	5	50%
5	5-9	Least (KS)	2	20%
	sum		10	100%

Based on the frequency distribution table of the physical fitness pre-test conducted on 10 IPK Kuamang volleyball club athletes, the classifications are as follows: no athletes were classified as "good", three athletes (30%) were classified as "medium", five athletes (50%) were classified as "less than good" and two athletes (20%) were classified as "least".

**Physical fitness post-test**

The results of the physical fitness post-test yielded a mean score of 15.2 with a standard deviation of 1.93. Scores ranged from a minimum of 12 to a maximum of 18. The frequency distribution can be viewed in the table 2.

**Table 2. Frequency distribution of physical fitness post-test results**

No	Number of values	Category	Frequency	
			Absolute (Fa)	Relative
1	22-25	Very Good (BS)	0	0%
2	18-21	Good (B)	2	20%
3	14-17	Medium (S)	6	60%
4	10-13	Less than medium (K)	2	20%
5	5-9	Least (KS)	0	0%
	sum		10	100%

Based on the frequency distribution table of the physical fitness post-test conducted on 10 IPK Kuamang volleyball club athletes, the classifications are as follows: none of the athletes were classified as "very good", two athletes (20%) were classified as "good", six athletes (60%) were classified as "medium", two athletes (20%) were classified as "less than medium" and none of the athletes were classified as "least".

**Normality test**

To test the research hypotheses, a t-test is employed. The Liliefors test, with a significance threshold of 0.05, is used to determine if the data are normally distributed. The results of the Liliefors test calculation can be seen in the table 3.

**Table 3. Physical fitness normality test**

Variable	Group	$L_{score}$	$L_{table}$	Information
Indonesian Physical Freshness Test (TKJI)	Pre test	0.1177	0.258	Normal
	Post test	0.1409		

From the results of the normality test calculations above, we observed that the calculated  $L_{score}$  ( $L_h$ ) is smaller than the  $L_{table}$  ( $L_t$ ) at the significance level ( $\alpha$ ) of 0.05. Based on this, we can conclude that the data are normally distributed.

**Homogeneity test**

The table below presents the results of the homogeneity test for the studied variables (Table 4).

**Table 4. Physical fitness homogeneity test**

Variable	$F_h$	$F_t$	Information
Indonesian Physical Freshness Test (TKJI)	1.49	3.18	Homogeneous

Based on the homogeneity test results, the outcome reveals that  $F_h$  is less than  $F_t$ . Thus, the data is determined to be homogeneous.

**Hypothesis testing**

Once the preliminary tests are conducted and the data for each variable satisfies the requirements for hypothesis testing, the t-

test is employed with a significance level of 0.05. There is a notable improvement in the physical fitness of volleyball athletes after undergoing circuit training. This improvement is evident from an average score of 12.3 and a standard deviation of 2.35 in the pretest, increasing to an average score of 15.2 and a standard deviation of 1.93 in the posttest.

**Table 5. Hypothesis testing results**

Indonesian Physical Fitness Test (TKJI)	Mean	SD	$T_{score}$	$T_{table}$	Test results	Information
Pre test	12.3	2.35	13.1	1.833	Significant	$H_1$ accepted
Post test	15.2	1.93				

Based on the table above, circuit training impacts the physical fitness level of athletes, with a  $t_{\text{score}}$  of 13.1, which is greater than the  $t_{\text{table}}$  value of 1.833. Consequently, the proposed hypothesis is accepted.

### Discussion

Physical activity is a vital aspect of daily life, significantly affecting health [27, 28]. While laymen view fitness as the ability to execute daily tasks without undue fatigue, athletes define it as the capacity to train without excessive fatigue, endure intense training sessions, and meet competitive demands [29].

Physical exercise plays a crucial role in daily life, aiding individuals in various tasks. A person's physical fitness level not only influences their daily capabilities but also critically impacts a child's growth and development [30]. A higher level of physical fitness equates to greater physical work capability [31]. To maintain optimal physical fitness, consistent and regular exercise is essential [32], with recommendations suggesting physical activity for 20–60 minutes, 3–5 days a week [33].

Statistical data indicates that circuit training has a pronounced effect on the physical fitness of volleyball athletes. This outcome arises because the training methods employed are effective and tailored to the athletes' physical health requirements. Circuit training has been proven to have numerous benefits, including enhancing male students' physical fitness and  $Vo_{2\text{max}}$  [34]. Moreover, exercises following the circuit game method have been shown to boost physical fitness [35].

### Acknowledgments

The author would like to thank Prof. Dr. Ahmad Nasrulloh, S.Or., M.Or and Dr. Sigit Nugroho, S.Or., M.Or as lecturers in the framework of writing scientific papers in the sports science study program at Yogyakarta State, and to Dr. Nugroho Susanto, S.Pd., M.Or who have assisted the author in completing this article. The author hopes this research will inform coaches, teachers, and athletes about the importance of circuit training programs to improve physical fitness.

Circuit training entails athletes transitioning between different training stations in a predetermined sequence as swiftly as possible [36]. This type of training is a conditioning method where participants shift from one exercise to the next, often involving diverse equipment or locations. Circuit exercises bolster overall fitness [37]. Such training programs are recognized for improving and sustaining muscle strength, muscular endurance, and flexibility among sports science students, and they also diminish the potential for sports injuries [38].

Based on the hypothesis test results, the physical fitness test computations reveal that circuit training considerably influences the IPK Kuamang volleyball club players. This conclusion is supported by the final statistical t-test, where  $t_{\text{count}} = 13.1 > t_{\text{table}} = 1.833$ . Thus, empirical evidence suggests that the circuit training program significantly impacts the physical fitness level of IPK Kuamang volleyball club athletes.

### Conclusion

The study's findings and analysis confirm that the circuit training program affects the physical fitness of IPK Kuamang volleyball club athletes.

Adres do korespondencji / Corresponding author

**Nugroho Susanto**

E-mail: nugrohosusanto@fik.unp.ac.id

### Piśmiennictwo/ References

1. D. Hanggara, Syafiral, and B. R. Ilahi, "Implementasi Estrakulikuler Bola Voli di SMA N 1,2 dan 3 Bengkulu Tengah," *Kinestik J. Ilm. Pendidik. Jasm.*, vol. 2, no. 1, pp. 16–22, 2018.
2. Ç. G. Kanbak and Ö. Dağlıoğlu, "Effect Of Plyometric Training Program On Speed and Dynamic Balance Performances In Volleyball Players," *Eur. J. Phys. Educ. Sport Sci.*, vol. 6, no. 9, pp. 138–145, 2020, doi: 10.46827/ejpe.v6i9.3500.
3. A. Kurniawati, Z. Arifin, E. Wandu, and I. Hermawan, "Pengaruh Modifikasi Permainan Bola Voli Terhadap Minat Siswa Dalam Pembelajaran Pendidikan Jasmani," *Holist. J. Sport Educ.*, vol. 1, no. 2, pp. 60–69, 2022, doi: 10.52434/hjse.v1i2.1965.
4. N. Bisht and S. Srivastava, "Impact of Physical and Mental Training on Overall Performance and Sports Injury Prevention in Female Volleyball Athletes," *Indian J. Physiother. Occup. Ther.*, vol. 15, no. 3, pp. 64–70, 2021, Online.. Available: <http://leedsbeckett.idm.oclc.org/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=ccm&AN=152593359&site=ehost-live&scope=site>
5. S. Nugroho, A. Nasrulloh, T. H. Karyono, R. Dwiandaka, and K. W. Pratama, "Effect of intensity and interval levels of trapping circuit training on the physical condition of badminton players," *J. Phys. Educ. Sport*, vol. 21, no. 3, pp. 1981–1987, 2021, doi: 10.7752/jpes.2021.s3252.
6. B. Mkaouer, S. Hammoudi-Nassib, S. Amara, and H. Chaabène, "Evaluating the physical and basic gymnastics skills assessment for talent identification in men's artistic gymnastics proposed by the International Gymnastics Federation," *Biol. Sport*, vol. 35, no. 4, pp. 383–392, 2018, doi: 10.5114/biolSport.2018.78059.
7. B. Kokarev, S. Kokareva, S. Atamanuk, O. Terehina, and S. Putrov, "Effectiveness of innovative methods in improving the special physical fitness of qualified athletes in aerobic gymnastics," *J. Phys. Educ. Sport*, vol. 23, no. 3, pp. 622–630, 2023, doi: 10.7752/jpes.2023.03077.
8. F. Fachrezzy, I. Hermawan, U. Maslikah, H. Nugroho, and E. Sudarmanto, "Profile Physical Fitness Athlete of Slalom Number Water Ski," *Int. J. Educ. Res. Soc. Sci.*, vol. 2, no. 1, pp. 34–40, 2021, doi: 10.51601/ijersc.v2i1.29.
9. D. H. Saunders et al., "Physical fitness training for stroke patients," *Cochrane Database Syst. Rev.*, vol. 2020, no. 3, pp. 1–3, 2020, doi: 10.1002/14651858.CD003316.pub7.
10. A. Aristiyanto, G. S. Pontang, S. Sukarno, and I. Ardiansyah, "PENGARUH CIRCUIT TRAINING TERHADAP INDEKS MASSA TUBUH DAN KEBUGARAN JASMANI ATLET HOCKEY KABUPATEN SEMARANG," *Nutr. Res. Dev. J.*, vol. 01, no. 02, pp. 13–21, 2021, Online.. Available: <https://journal.unnes.ac.id/sju/index.php/nutrizione/article/view/51757/20386>
11. A. Arifandy, E. Hariyanto, and U. Wahyudi, "Survei Tingkat Kebugaran Jasmani Siswa SMP," *Sport Sci. Heal.*, vol. 3, no. 5, pp. 218–234, 2021, doi: 10.17977/um062v3i52021p218-234.

12. R. Saputra, "Pengaruh Permainan Sirkuit Dengan Pos Terhadap Kebugaran Jasmani Siswa Di Sekolah Dasar Negeri 07 VII Koto Bisati Sungai Sariak Kabupaten Padang Pariaman," *J. Stamina*, vol. 3, pp. 667–674, 2020.
13. S. Haible, C. Volk, Y. Demetriou, O. Höner, A. Thiel, and G. Sudeck, "Physical activity-related health competence, physical activity, and physical fitness: Analysis of control competence for the self-directed exercise of adolescents," *Int. J. Environ. Res. Public Health*, vol. 17, no. 1, pp. 1–15, 2020, doi: 10.3390/ijerph17010039.
14. D. Tavoian, D. W. Russ, L. A. Consitt, and B. C. Clark, "Perspective: Pragmatic Exercise Recommendations for Older Adults: The Case for Emphasizing Resistance Training," *Front. Physiol.*, vol. 11, no. July, pp. 1–9, 2020, doi: 10.3389/fphys.2020.00799.
15. F. Huertas, R. Ballester, H. J. Gines, A. K. Hamidi, C. Moratal, and J. Lupiáñez, "Relative age effect in the sport environment. Role of physical fitness and cognitive function in youth soccer players," *Int. J. Environ. Res. Public Health*, vol. 16, no. 16, pp. 1–19, 2019, doi: 10.3390/ijerph16162837.
16. A. J. Cunanan et al., "The General Adaptation Syndrome: A Foundation for the Concept of Periodization," *Sport. Med.*, vol. 48, no. 4, pp. 787–797, 2018, doi: 10.1007/s40279-017-0855-3.
17. T. V. Shepelenko et al., "Structure of a year cycle of athletes training in aerobics (woman) with various psychophysiological and functional features," *Pedagog. Psychol. medical-biological Probl. Phys. Train. Sport.*, vol. 22, no. 1, pp. 35–43, 2018, doi: 10.15561/18189172.2018.0105.
18. A. Nasrulloh et al., "Triset Method to Increase the Hypertrophy Muscle," *J. Phys. Conf. Ser.*, vol. 1529, no. 3, pp. 1–6, 2020, doi: 10.1088/1742-6596/1529/3/032006.
19. J. Bovas, "Effect Of Circuit Training And Interval Training On Change Of Achievement Motivation In Kabaddi Player," *Int. J. Res. Anal. Rev.*, vol. 7, no. 1, pp. 967–977, 2020.
20. G. Jariono, H. Nugroho, I. Hermawan, F. Fachrezzy, and U. Maslikah, "The Effect of Circuit Learning on Improving The Physical Fitness of Elementary School Students," *Int. J. Educ. Res. Soc. Sci.*, vol. 2, no. 1, pp. 59–68, 2021, doi: 10.51601/ijersc.v2i1.22.
21. F. A. Engel et al., "Classroom-Based Micro-Sessions of Functional High-Intensity Circuit Training Enhances Functional Strength but Not Cardiorespiratory Fitness in School Children—A Feasibility Study," *Front. Public Heal.*, vol. 7, no. 291, pp. 1–9, 2019, doi: 10.3389/fpubh.2019.00291.
22. J. Wild, S. El-Salahi, and M. D. Esposti, "The Effectiveness of Interventions Aimed at Improving Well-Being and Resilience to Stress in First Responders: A Systematic Review," *Eur. Psychol.*, vol. 25, no. 4, pp. 252–271, 2020, doi: 10.1027/1016-9040/a000402.
23. D. P. Kumar, "Impact of Circuit Training on Selected Physical Fitness Among College Level Kabaddi Players," *Int. J. Phys. Educ. Sport. Heal.*, vol. 8, no. 1, pp. 35–38, 2021, Online.. Available: <http://pe.isrj.in/UploadedArticles/242.pdf>
24. J. Martins, J. Cardoso, S. Honório, and A. Silva, "The Effect of a Strength Training Programme in Adolescents in Physical Education Classes El efecto de un programa de entrenamiento de fuerza en adolescentes en clases de educación física," *Retos*, vol. 38, pp. 71–76, 2020.
25. A. H. Aga, "Twelve week effects of circuit exercise training on selected health related physical fitness: In case of Dambi Dollo University Second Year Students, Oromia, Ethiopia Ararsa," *Int. J. Health Sci. (Qassim)*, vol. 6, no. S1, pp. 7035–7040, 2022, doi: 10.53730/ijhs.v6ns1.6514.
26. S. Hermassi, K. Laudner, and R. Schwesig, "The Effects of Circuit Strength Training on the Development of Physical Fitness and Performance-Related Variables in Handball Players," *J. Hum. Kinet.*, vol. 71, no. 1, pp. 191–203, 2020, doi: 10.2478/hukin-2019-0083.
27. S. Sole, R. Ramírez-Campillo, D. C. Andrade, and J. Sanchez-Sanchez, "Plyometric jump training effects on the physical fitness of individual-sport athletes: A systematic review with meta-analysis," *PeerJ*, vol. 9, pp. 1–25, 2021, doi: 10.7717/peerj.11004.
28. F. B. Ortega, C. Cadenas-Sanchez, D. Lee, J. R. Ruiz, S. N. Blair, and X. Sui, "Fitness and Fatness as Health Markers through the Lifespan: An Overview of Current Knowledge," *Prog. Prev. Med.*, vol. 3, no. 2, pp. 1–10, 2018, doi: 10.1097/pp9.0000000000000013.
29. S. Rani and A. Malik, "A study of effects of circuit training on selected physical fitness variables of sports persons," *Int. J. Yogic, Hum. Mov. Sport. Sci.*, vol. 2, no. 2, pp. 10–14, 2017.
30. J. F. Sinuraya and J. B. N. B. Barus, "Tingkat Kebugaran Jasmani Mahasiswa Pendidikan Olahraga Tahun Akademik 2019/2020 Universitas Quality Berastagi," *Kinestetik J. Ilm. Pendidik. Jasm.*, vol. 4, no. 1, pp. 23–32, 2020, doi: 10.33369/jk.v4i1.10359.
31. J. Purba, A. Widowati, and W. J. Daya, "Peningkatan Kebugaran Jasmani Melalui Variasi Latihan Sirkuit dan Olahraga Aerobik Jumesli," *J. Ilmu Keolahragaan*, vol. 3, no. 1, pp. 10–16, 2020, Online.. Available: <https://doi.org/10.1016/j.jnc.2020.125798%0Ahttps://doi.org/10.1016/j.smr.2020.02.002%0Ahttp://www.ncbi.nlm.nih.gov/pubmed/810049%0Ahttp://doi.wiley.com/10.1002/anie.197505391%0Ahttp://www.sciencedirect.com/science/article/pii/B9780857090409500205%0Ahttp://>
32. R. L. Bile and Suharjana, "Efektivitas Penggunaan Model Latihan Kebugaran 'Bbc Exercise' Untuk Pemeliharaan Kebugaran Jasmani Mahasiswa," *Sport. J. Phys. Educ. Sport Recreat.*, vol. 3, no. 1, pp. 30–37, 2019, doi: 10.26858/sportive.v3i1.16857.
33. N. M. Zenitha and S. Hartoto, "Hubungan Aktivitas Fisik di Luar Jam Pelajaran PJOK Terhadap Tingkat Kebugaran Jasmani Siswa," *J. Pendidik. Olahraga dan Kesehat.*, vol. 7, no. 3, pp. 519–522, 2019.
34. S. C. Kaewwong et al., "The circuit exercise improved physical fitness and cardiovascular endurance in male college students," *Gazz. Medica Ital. Arch. per le Sci. Medicine*, vol. 182, no. 3, pp. 121–125, 2023, doi: 10.23736/S0393-3660.22.04913-0.
35. N. Ahmad, D. Septiawan, and M. Puspitaningsari, "The Effect of Circuit Games on Physical Fitness in Upper Class Students at SDN Tanggungan Gudo Jombang," *J. RESPECS (Research Phys. Educ. Sport)*, vol. 5, no. 1, pp. 127–132, 2023, Online.. Available: <https://ejournal.unma.ac.id/index.php/respecs/article/view/4210>
36. S. Velkumar and K. R. Kumar, "Impact of circuit training on selected physical fitness variables of male hockey players," vol. 4, no. 2, pp. 111–112, 2017.
37. P. Gopinathan, "Effect of circuit training on speed, agility and explosive power among inter collegiate handball players," *Int. J. Yogic, Hum. Mov. Sport. Sci.*, vol. 4, no. 1, pp. 1294–1296, 2019.
38. D. W. Mola and G. T. Bayeta, "Effect of circuit training on selected health-related physical fitness components: the case of sport science students," *Turkish J. Kinesiol.*, vol. 6, no. 4, pp. 142–148, 2020, doi: 10.31459/turkjkin.812512.