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Increase in Maximum Oxygen Volume (VO_2Max) Based on the Small Side Game Method

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Abstract VO_2Max is very important in football games. Currently, the average Student Training Education Center (PPLP) West Sumatra football player has a low VO_2Max capacity, so an exercise method is needed that can increase the athlete's VO_2Max capacity. In this case, the researcher provides a small game training method to raise the VO_2Max of players. The study's sample consisted of 40 people aged 14-17 years, using purposive sampling based on the researcher's own considerations. The players in this study sample have also been practicing for a long time, approximately 9 years. The average rise in scores between the first and final tests was found by statistical testing. It falls into the effective category with a minimum N Gain Score value of 0.4 and a maximum value of 0.9, and the pretest-posttest test results yielded a t-count value of -26.645 with a significance value of <0.01. If the sig value (2-tailed) < 0.05, then there is a significant difference between the pre-test and post-test results. So to increase good endurance in athletes, realistic exercises such as small side games are needed, so that the athlete's VO_2Max capacity can increase properly. So it is highly recommended for football players to improve their endurance by using this small side game method. Small side games training, in addition to developing technical play, also greatly improves the physical condition of athletes. It is important for coaches to apply this training method to improve abilities.

Keywords VO_2Max Ability, Exercise Method, Physical qualities in Football, Young Athletes

1. Introduction

Football games are played fast and at high speed in the present day. Attack to defense and defense to defense shift swiftly in both directions [1], [2]. Football moves are made both with and without the ball (with and without the ball). As in playing rugby a player in a squad and a football match covers a total running distance of 10–11 km, or 14 km of territory covered. 3 - 4.5 km of ball movement and 3.6 - 4.5 km of running without the ball [1], followed by 500 - 800 m of high-intensity running (21 - 24 km/h). Football players do a variety of actions along the 10 to 14 km course. A lot of VO_2Max is needed for football matches with high mobility and extended durations (2 x 45 minutes). Such as in the premier league a player needs a maximum oxygen capacity called VO_2Max [2]. VO_2Max is a body capacity measurement that can be represented in milliliters/minute/kg body weight or liters per minute [3]. VO_2Max refers to the respiratory system's ability to absorb

as much oxygen as possible during physical activity [4], [6]. People with good fitness have higher VO_2Max values and can perform stronger activities than those who are not in good condition [7]. If players don't have endurance, it will be difficult for them to perform in competitive football matches [8]. Physical growth is one of the most important factors that define how successfully football players execute their technical and tactical movements as individuals, teams, and groups. No matter how technically and tactically literate a soccer player is, he will never be successful without good, all-round physical fitness [9], [10], [11]. A team will also not succeed if the physical development of one of its players does not meet the standards of modern football [12]. For a football player, it is necessary to develop all of his physical qualities, especially during the preparation period for training [14]. The issue we frequently observe in VO_2Max training is players' boredom during the exercise regimen. This is a result of the lengthy nature of VO_2Max training [15], [16]. Other than that, the tasks are incredibly repetitive. It is believed that weariness from physical training and unsuitable training programs are the causes of not reaching training goals, so a method is required. The lack of variety in training methods, which only applies to long-distance running for physical training, makes training dull and less effective in improving athletes' abilities. Appropriate activity can raise your VO_2Max. This will be a challenge that occasionally causes players' VO_2Max increases to be sluggish or even stagnate [17]. To handle all of this, a breakthrough in selecting or developing the appropriate training strategy is needed. A range of training techniques, including interval training and fartlek training, are available for coaches to use in continuous training, and small-sided game training, to help football players improve their VO_2Max [11], [18], [19]. Professional football teams train using a variety of techniques to get better such as their players' physical attributes, as well as their general and specialized training regimens (such as position-specific ball exercises, football technique drills, and continuous, circuit, and interval training) and training sessions. A football player's VO_2Max can be raised using a variety of techniques - both broad approaches (without a ball) and more focused approaches (with a ball). The situation and the trainer's requirements determine which approach is best [20]. In order to raise players' VO_2Max, the researchers decided to employ the little side game strategy. Because it is best for training to be practical and branch-specific in order to build endurance in football, the tiny side game training method is a specific training method that results in real realistic football games. A small-sided game is one that is played on a field that is smaller than that of football generally, with rules that are altered, and with fewer players than the actual number of players [21]. Nowadays, adults and teenagers alike use small-sided games as a highly effective training tool [23]. The little side game may also demand that the player move constantly while playing [24]. The advantages of this small side game method include: (1) there are many technical, tactical and physical elements contained in one exercise, (2) in this exercise there are opponents playing so it is like a real game and there is an element of training, so small side games have many benefits. Among them are those that can improve physical fitness, motivation, and physical growth. The tiny side game approach has a significant impact on football training since it allows for unlimited substitutions and allows for a variety of game styles [27]. Additionally, this way of playing tiny side games has the benefit of being leisurely, informative, and competitive, and it doesn't require any certain amount of time, number of participants, resources, or infrastructure. It also uses short, simple rules. Since early game training should start with the most fundamental, straightforward, and entertaining components of the game, players are also thought to benefit greatly from the small-side game training technique. To receive passes and dribble the ball, players must move and look for empty spaces, win the ball from opponents and evade the opponent's guard [29], [30]. In this case, the researcher assumes that by providing training using the small side game method, significant changes will be seen in increasing the VO_2Max of athletes, and it will also be seen how much influence this training method has on increasing the VO_2Max capacity of football athletes. So that football coaches, especially in West Sumatra, can guide this training method to be used to increase aerobic capacity in playing football.

2. Materials and Methods

One group is used in this quasi-experimental study's pre- and post-test designs [31]. Football players from PPLP made up the study's population. Sampling using purposive sampling is based on the researcher's own considerations. Forty West Sumatra PPLP athletes, ranging in age from 14 to 17, made up the sample for this study. The sample selection used a total sampling technique, so that the entire population became the sample. Characteristics of the Under 17 sample have high knowledge of how to play but often forget to regulate the rhythm of the game. The players in this study sample have also been practicing for a long time, approximately 9 years. In addition, before the study was conducted, the players had stated that in the previous 4 months they had not participated in a competition so they were included in the researcher's criteria. The sample is a selection of grassroots players from various regions in Indonesia who have achieved quite good results at the national level.

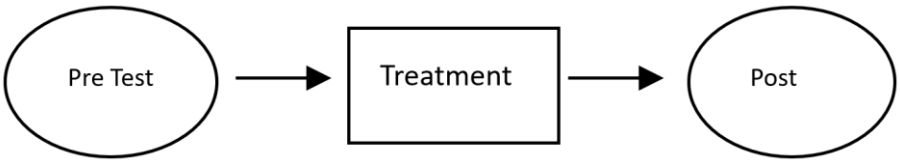

Figure 1. One Group Pre Test Post test

The instrument used in this research namely the Intermittent Yoyo Test is used to measure the VO_2Max capacity level of football athletes. Test participants will run back and forth for 20m. Given a recovery limit of 5 meters, in this test there are 25 levels in its implementation, and the higher the level, the better a person's cardiovascular system. In conducting this research, the researcher first made observations on West Sumatra PPLP football athletes, then after that the researcher carried out initial tests on all 40 football athletes. Next, the researchers designed a small side game training method. It was created using the training load principle. The sample then received treatment for 16 meetings [32]. The players' training program culminates in a final exam. Paired t-test analysis was employed to investigate this study's hypothesis using analytical techniques once final testing was completed. Data collection and processing were then carried out. In order to gather information on the effectiveness of different small-side game training techniques based on the best training principles utilized to observe an increase in the VO_2Max capacity of Football Athletes, a normality test must be performed before performing the Paired t-test analysis.

3. Results

First test is the ability of VO_2Max. After 40 samples were tested in the beginning, a minimum N Gain Score of 0.04, a maximum score of 0.9, a mean of 0.725, as well as a standard deviation of 0.01726 were discovered. Then the post test results after being given treatment with the Small Side Game obtained a minimum N_Gain_percent score of 4.15, maximum 8.93, mean 7.2550, and std, deviation 1.72616. A description of each data as a whole in the group is shown in Table 1 below:

Table 1. Characteristic Statistics

	N	Minimal	Maximal	Mean	Std Deviation
Ngain Score	40	.04	.09	.0725	.01726
Ngain Persen	40	4.15	8.93	7.2550	1.72616
Valid N (listwise)	40				

The N-Gain Score test computation results show that the average (mean) N Gain Score for the pretest and posttest is 0.725 or 0.73, included in the effective category, with an N-Gain Score value ranging from 0.4 to 0.9 at the lowest and greatest. The explanation of frequency distribution is shown in Table 2.

3.1. Pre Test (Initial Test)

After preparing the schedule for implementing the research, an initial test was conducted to obtain athlete performance scores. The test results are presented in the following table:

Table 2. Pretest Results' Frequency Distribution

No	Class Interval	Classification	Complete Frequency	Comparative Period (%)
1	< 51,52	Poor	5	13
2	51,52 - 54,54	Low	29	73
3	54,88 - 57,90	Moderate	6	15
4	58,24 - 59,25	Good	0	0
5	59,58 - 61,6	Very Good	0	0
6	> 61,6	Excellent	0	0
Total			40	100

Reference test norms; [33]

The explanation of the results of Table 2 is proven from the calculations shown in Table 2 that: 5 people 13% (less), 29 people 73% (low), and 6 people 15% (moderate). This proves how the initial ability is described based on the initial test of the athlete's VO_2Max ability.

3.2. Post Test (Final Test)

After the sample was given treatment with the small side games method, a final test was conducted to obtain the ability value from the results of the training carried out so that it can be tested to obtain the final hypothesis. The final test is presented in the following table:

Table 3. Distribution of Post-Test Frequencies

No	Class Interval	Classification	Complete Frequency	Comparative Period (%)
1	< 51,52	Poor	0	0
2	51,52 - 54,54	Low	7	18
3	54,88 - 57,90	Moderate	27	68
4	58,24 - 59,25	Good	6	15
5	59,58 - 61,6	Very Good	0	0
6	> 61,6	Excellent	0	0
Total			40	100

It is evident from the figures in the above table that 7 people have an 18% (poor) education, 27 have a 68% (middle) education, and 6 have a 15% (excellent) education.

3.3. Analysis Requirements Testing

The t-test technique was utilized to assess the study's premise. Prior to doing an analysis using the t-test, a normality test will be performed. Here's how normalcy testing works:

3.4. Normality Test

Prior to conducting a hypothesis test, an analysis is conducted using the Liliefors normality test statistics with a significance level of = 0.05. This is the normal distribution of the population. The purpose of this level of analysis is to establish the normality of a data distribution. For more details, please see table 4 below:

Table 4. Examinations of Normalcy

Shapiro-Wilk		
Statistic	Df	Sig.
0.953	40	0.098
0.959	40	0.152
*. This is a reduced threshold for the true significance..		
a. Adjusting the Significance of Lilliefors		

The statistical analysis of normality tests using the Shapiro-Wilk test revealed that VO_2Max data during the pretest and posttest provided normality test findings with a significant value of $p>0.05$, indicating that the data is normally distributed. The results showing the normality test data in the table above prove that the data can be tested to perform a different test from both the initial test and the final test. The normality test as a prerequisite test for analysis is carried out before testing the final hypothesis.

3.5. Hypothesis Testing

The study's hypothesis is that athletes' VO_2Max may be significantly increased by Small Side Game training. Using the Paired Sample Test Formula based on comparative analysis is shown as follows:

Table 5. Summary of hypothesis testing results

	Paired differences					t	Df	sig. (2-Tailed)
	Mean	Standard deviation	Standard error mean	95 % conviction interval for the distinction				
				Lower	Upper			
Pair 1. Test-Pretest-Posttest	-3.42500	0.81296	.12854	-3.68500	-3.16500	-26.645	39	<.001

Table 5 pretest-posttest analysis findings showed that the t-count value was -26.645 with a significance value of <0.01, indicating a strong correlation. The study's hypothesis, according to which playing small side games can aid athletes in raising their VO2Max, is approved if there is a significant difference between the pre- and post-test results (sig value 2-tailed) < 0.05.

4. Discussion

According to hypothesis data, training with Small Side Games significantly affects participants' VO_2Max increases. This is based on the results of the N-Gain Score test calculation, which indicate that the N Gain Score Pretest and Posttest have an average value (mean) of 0.725 or 0.73, putting them in the effective category with a maximum N-Gain Score value of 0.9 and a minimum of 0.4, as well as the high category on the N Gain %. Moreover, with a significance value of less than 0.01 and a t-value of 26.645, based on the pretest-posttest comparison. If (2-tailed) sig value is less than 0.05, the hypothesis put forth in this study, that there is an effect of Small Side Games training on increasing VO_2Max, is accepted when there is a significant difference between the pre-test and post-test results. As a result, the training method involving small side games is said to be effective for increasing VO_2Max. The results of this investigation are supported by further research, as shown by [34]. Highlighting the substantial impact that the Small Side Game method's pre- and post-tests have on football players' endurance, which is determined by output, there is a sig value for pair 1. There is a difference between the average VO_2Max findings of the Pretest experimental class and the Posttest Small Side game experiment, as indicated by the 2-tailed value of 0.000 < 0.05. Then in the Pair 2 output the sig value is obtained. (2-tailed) of 0.000 < 0.05, it can be concluded that there is a difference in the average VO_2Max results of the Pre-test control class and the control (conventional) Post-test in several other studies produced by [18], [35], [36] , which found that giving small-sided game training treatment for 16 meetings had an effect on increasing athletes' endurance, which was seen from the calculated significant value in the t-test of 0.000 or could be interpreted as (0.000 < 0 .05). The results of this research support previous research conducted [37]. These studies also show that there is a significant effect of small side games training on increasing VO_2Max. Theoretically the small side game method also allows progress to the same level as short intermittent running [38], in addition the Small side game method can also be used to provide more variety during training, combining physical, technical and tactical training closer to the intensity of intermittent running short duration but with higher variability [39] in order for it to effectively raise the VO_2Max capacity of athletes [40], [41]. It is also conceptually explained that VO_2Max refers to the body's maximum oxygen consumption during exercise and training [8]. VO_2Max is also the main indicator for measuring athlete performance and cardiovascular adaptation to training loads [42]. The model created for football training needs to be more targeted and incorporate a ball, as sports should ideally be performed with a ball as a medium to improve VO_2Max and endurance [43], [44], [45], [46]. The same thing is also explained by [41], who also clarify that football players need to employ specific training, including mini games, football skill training, and position-specific training in the game, in order to improve their physical condition [42], [43] where the Small Side Game approach has integrated each of the models mentioned. Athletes with high VO_2Max levels can exert themselves physically without restriction, recuperate quickly, and work extended shifts without feeling fatigued. Athletes in football can determine their level of endurance by measuring and observing their VO_2Max capacity. The primary metric used to assess cardiorespiratory fitness is VO_2Max [44]. Naturally, achieving a decent VO_2Max level requires following a methodical approach; similarly, reaching peak performance requires a lengthy training regimen that is planned, directed, and ongoing in accordance with the demands of the athlete's sport. Athletes engage in a variety of physical and psychological (mental) exercises during the training process under the supervision of a coach in an effort to enhance and sustain performance [45]. Training using the small side game method which is when training is done methodically and according to a schedule, it can effectively raise a player's VO_2Max capacity. However, it's important to remember that a person's drive to follow a disciplined training regimen also plays a role in determining their maximal VO_2Max [46], so that if small side game training is carried out systematically, programmed and well structured coupled with good discipline from the athletes, it will be able to significantly increase the VO_2Max capacity of football athletes, so that in football game, athletes will have a good level of endurance data and good technical skills. From the discussion above, it can be concluded that the Small Side Game is very dominant in influencing VO_2Max, because in training all variations of movements or material given will be repeated again with intensity and load increasing day by day, but techniques, tactics and conditions also support the success of the Small Side Game, so that what is expected can be achieved.

5. Conclusions

Based on the results of data analysis and discussion, it can be concluded: there is a significant influence of the Small Side Game on increasing VO_2Max athletes. This can be seen from the increase in average VO_2Max by practicing using the Small Side Game with an average (mean) N Gain Score Pretest and Posttest of 0.725 or 0.73 included in the effective category with a minimum N-Gain

Score value of 0.4 and a maximum of 0.9, and included in the high category in the N Gain percentage. And based on the results of the pretest-posttest t-test, the t-count value is obtained at 26.645 with a significance value <0.01. If the sig value. (2-tailed) < 0.05, then there is a significant difference between the pretest and posttest results. This means that there is an increase in VO_2Max test results by practicing using the Small Side Game.

Based on this research, a football coach should start providing training using the small side game method to increase the VO_2Max capacity of football athletes. Training using the small side game method should not be ignored by a football coach, because in training using the small side game method, apart from being able to increase the player's VO_2Max capacity, it can also indirectly improve the basic technical skills of football players, because this training method is a method that is played in accordance with a realistic football game, so that all technical components are also involved in the training process carried out. Small side games training, in addition to developing technical play, also greatly improves the physical condition of athletes. It is important for coaches to apply this training method to improve abilities.

Conflicts of Interest

The authors mention that there is no "Conflict of Interest" in this study.

REFERENCES

[1] T. Bompa and F. Claro, *Periodization in rugby*. Meyer & Meyer Verlag, 2015. Accessed: Oct. 28, 2024. [Online].

[2] C. P. Barros and P. Garcia-del-Barrio, 'Efficiency measurement of the English football Premier League with a random frontier model', *Economic modelling*, vol. 25, no. 5, pp. 994–1002, 2008.

[3] W. T. Cade *et al.*, 'Peak oxygen uptake (VO2peak) across childhood, adolescence and young adulthood in Barth syndrome: Data from cross-sectional and longitudinal studies', *PLoS ONE*, vol. 13, no. 5, pp. 1–12, 2018, doi: 10.1371/journal.pone.0197776.

[4] F. Dahlan and A. Alimuddin, 'VO2max Intensity Through Interval Training and Circuit Training', *JUARA : Jurnal Olahraga*, vol. 4, no. 2, p. 160, 2019, doi: 10.33222/juara.v4i2.581.

[5] A. Okilanda, F. Dlis, H. Humaid, D. D. Putra, and M. Arisman, 'Defense warm-up exercise material for 13-age athlete using video technology in covid-19 era', *International Journal of Human Movement and Sports Sciences*, pp. 629–634, 2021.

[6] P. Hedison, 'PENGARUH LATIHAN FISIK AEROBIK TERHADAP VO2MAX PADA MAHASISWA PRIA DENGAN BERAT BADAN LEBIH (OVERWEIGHT)', *jurnal e - Biomedik (EBM)*, vol. 1, no. 2, 2013.

[7] R. Bahtra, A. N. Putra, D. Tohidin, M. S. Rifki, and W. W. Dinata, 'The Development of the Endurance Training Model Based on Technique Drill', *International Journal of Human Movement and Sports Sciences*, vol. 10, no. 4, pp. 654–659, 2022, doi: 10.13189/saj.2022.100404.

[8] I. Ilham *et al.*, 'Comparative Analysis of Adaptations Progress in VO2max, Leg Power, and Agility among Male and Female Sports Science Students', *Retos: nuevas tendencias en educación física, deporte y recreación*, no. 57, pp. 245–257, 2024.

[9] N. Ihsan, A. Okilanda, D. Donie, D. D. Putra, S. Wanto, and A. Arisman, 'Practical Group Defense Exercise Design in Football Game for 13-Year-Old Students', *Teoriâ Ta Metodika Fìzičnogo Vihovannâ*, vol. 22, no. 2, pp. 194–201, 2022.

[10] R. Bahtra and M. Asmawi, 'The Endurance Ability Analysis Persikopa Football Players of Pariaman City', in *1st International Conference on Sport Sciences, Health and Tourism (ICSSHT 2019)*, Atlantis Press, 2021, pp. 336–339. Accessed: Feb. 01, 2024. [Online]. Available: https://www.atlantis-press.com/proceedings/icssht-19/125951978

[11] G. Polevoy, 'Comprehensive development of physical qualities of football players in the preparatory period', *Retos*, vol. 57, pp. 172–178, 2024, doi: 10.47197/retos.v57.105912.

[12] U. S. A. O'g'li., 'Developing the physical qualities of young football players outside the class and preparing them for competitions.', *Academicia Globe: Inderscience Research*, vol. 3, no. (12), pp. 20-23.

[13] A. S. Wahyuri, R. Batubara, and A. Okilanda, 'Implementation of small side games in the learning process education physical sports and health at SMK Padang', *Retos: nuevas tendencias en educación física, deporte y recreación*, no. 50, pp. 1135–1139, 2023.

[14] A. A. Yudi *et al.*, 'How can Small Sided Game training methods (3 vs 3 and 6 vs 6) and VO2max affect basic soccer skills?', *Retos*, vol. 52, pp. 550–557, 2024.

[15] G. P. W. Prakoso and F. Sugiyanto, 'Effect of training method and leg muscle endurance on the results of VO2Max capacity increase of basketball players', *Jurnal Keolahragaan*, vol. 5, no. 2, p. 151, 2017, doi: 10.21831/jk.v5i2.10177.

[16] A. U. K. Putra, I. N. Sudjana, and F. Amiq, 'The Effect of Small Sided Games Training on Improving the Vo2Max Ability of U-17 Football Players in the Smuba Junior Football Association of Batu City', *Jurnal Pendidikan Jasmani*, vol. 25, no. 1, pp. 20–30, 2016.

[17] R. Bahtra, D. Tohidin, Y. Andria, W. W. Dinata, and N. Susanto, 'Small-Sided Games 5v5: Improving Aerobic Endurance of Youth Football Players', *Physical Education Theory and Methodology*, vol. 23, no. 5, pp. 739–746, 2023.

[18] C. Lago-Peñas, 'The role of situational variables in analysing physical performance in soccer', *Journal of Human Kinetics*, vol. 35, no. 1, pp. 89–95, 2012, doi: 10.2478/v10078-012-0082-9.

[19] S. V. Hill-Haas, B. Dawson, F. M. Impellizzeri, and A. J.

Coutts, 'Physiology of small-sided games training in football: A systematic review', *Sports Medicine*, vol. 41, no. 3, pp. 199–220, 2011, doi: 10.2165/11539740-000000000-00000.

[20] H. Sarmento and F. M. Clemente, *Small Sided Games in soccer-A Systematic Review Running title: Soccer literature review 5*. 2018.

[21] D. T. M. Ningrum, J. Tangkudung, J. Lubis, A. R. Riza, and E. T. Denatara, 'The effectiveness of small side games (Ssg) in forearm pass volleyball use application in mobile phone', *International Journal of Human Movement and Sports Sciences*, vol. 9, no. 4, pp. 642–647, 2021, doi: 10.13189/saj.2021.090406.

[22] K. C. A. Kusuma and I. K. H. Kardiawan, 'The Effect of Touch of The Ball in Small Side Games on The Improvement Vo2max Amateur Football Players', *Journal of Physical Education, Sport, Health and Recreations*, vol. 7, no. 3, p. 129, 2018.

[23] A. Manoj Kumar, 'An outcome of periodized Small Side Games with and without mental imagery on playing ability among intercollegiate level soccer players', *Indian Journal of Science and Technology*, vol. 8, no. 36, pp. 8–11, 2015, doi: 10.17485/ijst/2015/v8i36/87555.

[24] R. APRILIYANTO, 'The Effect of Small Sided Games Training on Increasing Maximum Aerobic Capacity and Dribbling Skills in Football Players', *Biormatika : Jurnal Ilmiah Fakultas Keguruan Dan Ilmu Pendidikan*, vol. 5, no. 01, p. 56, 2019, doi: 10.35569/biormatika.v5i01.414.

[25] P. O'Donoghue, *Statistics for sport and exercise studies: An introduction*. Routledge, 2013. Accessed: Oct. 28, 2024. [Online]. Available: https://www.taylorfrancis.com/books/mono/10.4324/9780203133507/statistics-sport-exercise-studies-peter-donoghue

[26] J. C. De Winter, 'Using the Student's t-test with extremely small sample sizes', *Practical Assessment, Research, and Evaluation*, vol. 18, no. 1, p. 10, 2019.

[27] R. Bahtra, A. N. Putra, Septri, W. W. Dinata, Y. Andria, and N. Susanto, 'Improving Endurance Ability through Endurance Training Model-Based Drill Technique', *International Journal of Human Movement and Sports Sciences*, vol. 11, no. 2, pp. 335–341, 2023, doi: 10.13189/saj.2023.110210.

[28] R. R. Pratama *et al.*, 'The Effectiveness of Small Side Games in Increasing the Vo2Max Ability of Football Athletes', *International Journal of Human Movement and Sports Sciences*, vol. 12, no. 1, pp. 1–8, 2024, doi: 10.13189/saj.2024.120101.

[29] P. N. Pitri, 'The Influence of Small Sided Game in Increasing the Aerobic Capacity of Women's Volleyball Players of Stkip Muhammadiyah Kuningan', *Journal of Physical Education and Sport Science*, vol. 5, no. 2, pp. 20–27, 2023, doi: 10.33222/jpess.v5i2.2360.

[30] F. D. Syaroni and I. D. M. A. Wijaya Kusuma, 'Comparison of Fartlek and Small Side Games to Increase Vo2Max in Extracurricular Students', *JSES : Journal of Sport and Exercise Science*, vol. 3, no. 1, p. 37, 2020, doi: 10.26740/jses.v3n1.p37-41.

[31] 'Football Players', *Strength And Conditioning*, vol. 18, no. 3, pp. 491–497, 2004.

[32] I. Aziz *et al.*, 'Correlational study: Sports Students' special test results and basic athletic training learning outcomes', *Retos: nuevas tendencias en educación física, deporte y recreación*, no. 49, pp. 519–524, 2023.

[33] A. Dellal, K. Chamari, A. Pintus, O. Girard, T. Cotte, and D. Keller, 'Heart rate responses during small-sided games and short intermittent running training in elite soccer players: A comparative study', *Journal of Strength and Conditioning Research*, vol. 22, no. 5, pp. 1449–1457, 2008, doi: 10.1519/JSC.0b013e31817398c6.

[34] Y. Yendrizal *et al.*, 'Unlocking the science of physical endurance: Training techniques and biological factors', *Retos: nuevas tendencias en educación física, deporte y recreación*, no. 55, pp. 504–512, 2024.

[35] F. Syamsudin, N. Ayubi, A. Okilanda, and G. E. Virgriawan, 'Interval Training is better than Endurance Training for Improving VO2max', in *Proceedings of International Conference on Physical Education, Health, and Sports*, 2024, pp. 326–333. Accessed: Oct. 28, 2024. [Online]. Available: https://proceeding.unnes.ac.id/icophs/article/view/3526

[36] F. A. Muñoz-Martínez, J. Rubio-Arias, D. J. Ramos-Campo, and P. E. Alcaraz, 'Effectiveness of Resistance Circuit-Based Training for Maximum Oxygen Uptake and Upper-Body One-Repetition Maximum Improvements: A Systematic Review and Meta-Analysis', *Sports Medicine*, vol. 47, no. 12, pp. 2553–2568, 2017, doi: 10.1007/s40279-017-0773-4.

[37] A. Jaspers, M. S. Brink, S. G. M. Probst, W. G. P. Frencken, and W. F. Helsen, 'Relationships Between Training Load Indicators and Training Outcomes in Professional Soccer', *Sports Medicine*, vol. 47, no. 3, pp. 533–544, 2017, doi: 10.1007/s40279-016-0591-0.

[38] M. Russell, *et al.*, "Changes in Acceleration and Deceleration Capacity Throughout Professional Soccer Match-Play", Journal of Strength and Conditioning Research, vol. 30, no. 10, pp. 2839–2844, 2016, doi: 10.1519/JSC.0000000000000805

[39] B. J. McMorrow, M. Ditroilo, and B. Egan, 'Effect of heavy resisted sled sprint training during the competitive season on sprint and change-of-direction performance in professional soccer players', *International Journal of Sports Physiology and Performance*, vol. 14, no. 8, pp. 1066–1073, 2019, doi: 10.1123/ijspp.2018-0592.

[40] Martín-García, Andrés, *et al.*, "Quantification of a Professional Football Team's External Load Using a Microcycle Structure", Journal of Strength and Conditioning Research, vol. 32, no. 12, pp. 3511–3518, 2018, doi: 10.1519/JSC.0000000000002816.

[41] N. Gilbert *et al.*, 'Sports Science & Coaching Sports Science', *Journal Sport Area*, vol. 3, no. 3, 2008.

[42] M. Arnando *et al.*, 'The Influence of Agility Training on the Badminton Athletes' Ability', International Journal of Human Movement and Sports Sciences, vol. 12, no. 2, pp. 356-362, 2024, doi: 10.13189/saj.2024.120210.

[43] Y. Arnaldo and A. Fikri, 'The Effect of Zig-Zag Dribbling and Triangle Dribbling on Futsal Skills for U13 Athlete Using Video', 2023, Accessed: Oct. 28, 2024. [Online]. Available: https://www.academia.edu/download/103021286/SAJ29_19992375.pdf

[44] V. H. Arboleda-Serna, Y. Feito, F. A. Patiño-Villada, A. V. Vargas-Romero, and E. F. Arango-Vélez, 'Effects of high-intensity interval training compared to moderate-intensity continuous training on maximal oxygen consumption and blood pressure in healthy men: A randomized controlled trial', *Biomédica*, vol. 39, no. 3, pp. 524–536, 2019, doi: 10.7705/biomedica.4451.

[45] A. A. Yudi, 'The Effect of Small Sided Game Practice on the Passing Skills of SMAN 4 Sumba Studentsr', *Jurnal Cerdas Sifa*, no. 2, pp. 1–8, 2019.

[46] J. Arwandi and E. Ardianda, 'Zig-Zag Run Practice and Shuttle Run Practice Affect Football Dribbling Ability', *Jurnal Performa Olahraga*, vol. 3, no. 01, pp. 32–32, 2018.