

The effect of training on the reaction speed of fencing athletes

Kodrad Budiyo^{1,2*}, Tomoliyus¹, Endang Rini Sukamti¹, Susanto³

¹ Sport Coaching Education Program, Faculty of Sport and Health Science, Universitas Negeri Yogyakarta, Indonesia.

² Sport Coaching Education Program, Universitas Tunas Pembangunan Surakarta, Indonesia.

³ UIN Sayyid Ali Rahmatullah Tulungagung, Indonesia.

* Correspondence: Kodrad Budiyo; kodradbudiyo.2024@student.uny.ac.id

ABSTRACT

Good reaction speed is essential for coping with the intense demands of fencing competitions, requiring athletes to maintain a high level of physical fitness. The movements performed in fencing require well-developed physical abilities to achieve optimal performance. This study aimed to examine the effect of different training methods on the reaction speed of fencing athletes. This quantitative study employed an experimental research design to determine the effect of training methods on reaction speed. The study sample consisted of 30 athletes. The study included three independent variables: circuit training, interval training, and fartlek training, and one dependent variable: reaction speed. The results of the ANOVA indicated a statistically significant difference in reaction speed among the different training methods ($F=3.365$, $p=0.033$). The findings indicate that the training methods examined in this study were associated with differences in the reaction speed of fencing athletes. Circuit training may be a practical form of training for improving physical fitness while requiring relatively little training time. Further research is recommended to investigate the long-term effects of these training interventions in larger and more diverse populations.

KEYWORDS

Training; Reaction Speed; Fencing; Athletes

1. INTRODUCTION

Fencing is one of the sports with few fans (Taufiqi & Ismalasari, 2023). Fencing is a type of martial art where players use special swords to attack and defend against opponents. The objective of a fencing match is to attack the opponent with a sword while avoiding counterattacks. Fencing is typically played as a one-on-one match, but there are also team matches. The piste, which is used for fencing, is approximately 14 meters long and 2 meters wide, with an on-guard line that determines the starting position of the players. In fencing matches, each round lasts 3x3 minutes, so sufficient stamina is required to complete the match (Supriyoko & Mahardika, 2018). Fencing matches consist of three rounds, each lasting three minutes. The winner is awarded a total of fifteen points, or the highest point total after three rounds. A five-point system within three minutes is also available. Fencing is a sport that not only requires mastery of technique, strategy, and mental ability but also good reaction speed to perform all activities in the fencing game. This is because fencing is conducted in a relatively short time. Therefore, players must have good reaction speed so that they can achieve maximum performance during competitions. In the training process, measured training is needed to improve reaction time, which is an important component of overall athletic performance (Balkó et al., 2017). Studies on advanced and beginner fencing players show that reaction time to tactical stimuli is slightly shorter than to visual stimuli (Borysiuk & Waskiewicz, 2008). Symmetrical movements are a way to develop individual coordinative skills and prevent injuries (Johne, 2021).

Good reaction speed is necessary to face the intense competition in a fencing match. The competition requires the players' bodies to be in top condition, not just a healthy physical condition. In every number used in fencing, all of them require excellent physical abilities if they are to be used to achieve the best performance (Laksari et al., 2022). There are four physical components required in fencing. These physical components include endurance, strength, speed, and power. These physical components are interconnected and necessary to achieve peak condition in fencing (Barth, 2017). Speed is the ability to perform movement or displacement in a short time (Welk et al., 2015). Speed is divided into three namely sprint speed, reaction speed, and moving speed (Suharno, 1985). In fencing the type of speed used is reaction speed (Lakasari et al., 2022). Reaction speed is the ability to perform similar movements in the shortest possible time (Zulkifli et al., 2019). The success of a fencer in winning a match is largely determined by the level of reaction speed. Fencers are required to make fast and precise movements in carrying out attacks. The goal is that the opponent does not have time to read the movement and make a parry movement. In addition to attacks, defensive movements or parries from fencers also require a high level of speed. The importance of

reaction speed for fencing athletes is stated that “the time a person takes to respond to a signal. A good reaction time is essential in karate, as it enables an opponent's body movements or attack to be identified early, allowing decisive or evasive action to be taken if necessary” (Syaquro et al., 2017).

Training to increase speed can be done with several forms of exercise. The combination of shadow training with drilling has been studied to increase reaction speed and accuracy in smash in badminton (Cahyaningrum et al., 2018). Training with the drilling method on each technique movement can accelerate the mastery of movement skills and can strengthen the connection or speed of response and control the motor aspects with programmed training (Chansrisukot, 2015). Tools in sports can also be used to increase reaction speed. For fencing, there is a tool to increase reaction speed, namely Electric Fencing Target 1 (EFC-1). Reaction time in fencing attack patterns can be improved by doing exercises using EFC-1 (Prakosa et al., 2021).

Based on this explanation, it is very understandable why fencers must have good reaction speed. The outcome of the match is largely determined by the quality of the game shown by each player. When players in the arena often occur players lack reaction speed which results in defeat in a match. There needs to be an effort to find out the reaction speed of fencing athletes in Surakarta City. One of the efforts to find out the reaction speed of fencing athletes in Surakarta City is to identify factors that affect reaction speed including training and age so that fencing athletes who have good reaction speed can undergo the match well. In addition, modifying play-based training also contributes to reaction speed (Susanto et al., 2022).

2. METHODS

This study aimed to obtain a comprehensive picture of the effect of training on reaction speed, as well as to analyze the interaction between training and the reaction speed of fencing athletes in Surakarta City. The results of this study are expected to be a relevant reference for fencing coaches in increasing the reaction speed of athletes and provide benefits in the form of contributions in fostering and improving athlete performance.

This was a quantitative study using an experimental research method to determine the effect of independent variables on dependent variables based on the main influencing factor, namely training. The sampling technique used was purposive sampling. The study sample consisted of thirty athletes.

The current study consists of three independent variables, namely circuit training, interval training, and fartlek training, and one dependent variable, namely reaction speed. The training

program in this study consists of three exercises as follows: 1) Circuit training, where each station has different exercise items, namely: a) push-ups, b) pull-ups, c) sit-ups, d) squat jumps, and e) high jumps. 2) Interval training, regular jump rope exercises: 5 x 1 minute with a 30-second rest period. Jump rope for 1 minute at a fairly fast pace, stop for 30 seconds, and after the rest period ends, repeat the exercise 5 times for 1 minute. 3). Fartlek training, a form of exercise that combines various speeds, namely slow, moderate, and fast. The exercises include walking, jogging, and sprinting. The data collected in this study includes pre-test and post-test data on the reaction speed of fencing athletes in Surakarta City. The training lasted for 6 weeks, conducted three times a week. The validity of the instrument using the “Whole Body Reaction Time Test” has been validated in previous sports science literature.

Data analysis in this study was as follows: 1). Data was described by calculating the mean, median, standard deviation, variance, minimum value, and maximum value. 2). Normality testing used the non-parametric Kolmogorov-Smirnov test. 3). Homogeneity testing used the Levene test via SPSS 26. 4). Hypothesis testing was conducted using ANOVA, Tukey HSD (Honestly Significant Difference) test, and further analysis via SPSS 26.

3. RESULTS

The results of the data analysis that will be presented are pretest and post-test data on reaction speed based on the training of fencing athletes in Surakarta City. The final reaction speed value was obtained from the results of the reaction speed test using the “Whole Body Reaction Time Test”. The test results were then entered into a tally table to provide a descriptive summary of the research data, as presented in the table below.

Table 1. Circuit training, interval training, and Fartlek training data on reaction speed

Exercise	Reaction Speed	Mean	Median	SD	Minimum	Maximum
Circuits	Pretest	57,7	57,5	5,98	49	66
	Post-test	64,2	65,5	5,87	53	71
Interval	Pretest	56,1	57,5	6,42	47	66
	Post-test	62	63,5	5,27	55	70
Fartlek	Pretest	56,8	58,5	5,33	50	64
	Post-test	61,5	62	4,97	54	69

The mean reaction speed increased from 57.7 to 64.2 in the Circuit group, from 56.1 to 62.0 in the Interval group, and from 56.8 to 61.5 in the Fartlek group. The median values also increased across all three training groups, while the standard deviations remained relatively similar. Overall, the descriptive results indicate an improvement in reaction speed following all three types of training, with the largest increase in the mean observed in the Circuit Training group (6.5 points).

Table 2 presents the results of the normality test for reaction speed in the Circuit, Interval, and Fartlek training groups.

Table 2. Exercise normality test results

Exercise	Reaction Speed	p value	Significance	Description
Circuits	Pretest	0,593	> 0,05	Normal
	Post-test	0,408		Normal
Interval	Pretest	0,423		Normal
	Post-test	0,451		Normal
Fartlek	Pretest	0,907		Normal
	Post-test	0,948		Normal

All Asymp. Sig. values were greater than 0.05, ranging from 0.408 to 0.948. Therefore, the reaction speed data for both the pretest and post-test in all three groups were normally distributed. Table 3 presents the results of the homogeneity test for reaction speed.

Table 3. Homogeneity test results

Reaction Speed	Levene Statistic	df1	df2	p value
Pretest	0,246	3	28	0,863
Post-test	0,575	3	28	0,636

The significance value was 0.863 for the pretest and 0.636 for the post-test, both of which were greater than 0.05. Thus, the data can be considered homogeneous, indicating that the variance of reaction speed was similar across the three exercise groups. In the following, Table 4 presents the results of the ANOVA hypothesis test.

Table 4. Hypothesis test results using ANOVA analysis

Source	Type III Sum of Squares	df	Mean Square	F	p value
Corrected Model	41,045	3	13,682	3,365	0,033

Based on Table 4, hypothesis testing using ANOVA analysis shows that circuit training significantly outperforms interval and fartlek training in improving reaction speed ($F = 3.365$, $p = 0.033$). This indicates that good and proper technical skills certainly require high physical ability to support the learning process. In physical training, of course, you must pay attention to the methods, forms, and principles of training. There are many methods and forms of physical and technical training that coaches can apply to their students.

4. DISCUSSION

Circuit training, with a mean score of 64.2, was found to be better than interval and fartlek training, with mean scores of 62 and 61.5 respectively. This is in accordance that circuit training is structured to develop strength, power, muscular cardiovascular endurance, speed, agility, and flexibility which is a combination of cardio and speed training (Yudiana et al., 2012). Circuit training is one of the most beneficial forms of speed training. With circuit training, body fitness can be achieved without spending much time. The training method also affects the reaction speed of an athlete, thus routine and consistent activities are very beneficial (Adib et al., 2023).

Fencing athletes must have the ability to react quickly to an opponent's attack. The reaction speed of fencing athletes needs to be improved because if the athlete's reaction speed is good then the athlete can quickly parry the opponent's attack when receiving it. In addition, this needs to be improved to prepare athletes for matches, especially when competing with athletes who have good or even better reaction speed. The ability to react quickly to an opponent's attack, such as deflecting it, is very important for fencing athletes. A fencer must always be alert and prepared for attacks from opponents when they are in a defensive position (Henjilito, 2017). Based on the results of research on 14 Balangan Regency fencing athletes, 50% of athletes have reaction speed in the deficient category (Munawarah et al., 2023). Athletes need to speed up reactions because if one of them reacts more slowly, other athletes can parry their attacks and then counterattack. Reaction speed can also be applied with game-based training so that athletes do not get bored easily (Susanto et al., 2024). Reaction speed is very important to determine how fast an athlete's reaction is (Kemala, 2019).

Circuit training is one method that can be given to young athletes to improve their overall physical condition. The main objectives of circuit training in physical conditioning include strength, cardiovascular endurance, flexibility, and speed. During the transition phase or general preparation phase, general physical and technical improvements are needed to evaluate the time that has passed (Permana & Suharjana, 2013). This training can simultaneously improve the overall fitness of the

body's physical condition components, namely strength, endurance, speed, flexibility, mobility, and other components. In training programs, circuit training typically uses machines, hydraulic equipment, or even simple equipment. Generally, the interval between each station is approximately 15 seconds to 3 minutes to prevent muscle fatigue. The form of exercise in circuit training combines all physical elements. Therefore, circuit training is suitable for improving an athlete's reaction speed. Additionally, regular and disciplined circuit training can enhance an athlete's physical fitness (Susanto et al., 2021). Athlete motivation and previous training history may influence the results but were not controlled for in this study. One limitation is the small sample size and short training duration. Future research should investigate the long-term effects of the training method on a larger and more diverse population.

5. CONCLUSIONS

Based on the results of the study and discussions, it can be concluded that there are differences in the effects of circuit training, interval training, and fartlek training on reaction speed. Circuit training has a better effect than interval training and fartlek training on the reaction speed of fencing athletes in Surakarta City. There is a difference in the effects between early age and pre-cadet age on reaction speed. Pre-cadet age has a better effect than early age on the reaction speed of fencing athletes in Surakarta City. It is recommended that coaches prioritize circuit training in the early phases of training. Further research is needed to explore age-specific adaptations and the effects of training frequency.

6. REFERENCES

1. Adib, K., Sumiharsono, R., & Triwahyuni, E. (2023). Pengaruh Metode Latihan dan Penggunaan Media Video Terhadap Kecepatan Reaksi Atlet Bola Voli. *EDUKASIA: Jurnal Pendidikan dan Pembelajaran*, 4(2), 1811-1818.
2. Balkó, Š., Rous, M., Balkó, I., Hnízdl, J., & Borysiuk, Z. (2017). Influence of a 9-week training intervention on the reaction time of fencers aged 15 to 18 years. *Physical Activity Review*, 5, 146-154.
3. Barth, B., & Barth, K. (2017). *Learning fencing: A training and activity book for 6- to 10-year-olds*. Meyer & Meyer Sport.
4. Borysiuk, Z., & Waskiewicz, Z. (2008). Information processes, stimulation and perceptual training in fencing. *Journal of Human Kinetics*, 19(1), 63-82.
5. Cahyaningrum, G. K., Asnar, E., & Wardani, T. (2018). Perbandingan latihan bayangan dengan drilling dan strokes terhadap kecepatan reaksi dan ketepatan smash. *J Sport: Jurnal Penelitian Pembelajaran*, 4(2), 159-170.
6. Chansrisukot, G., Suwanthada, S., & Intiraporn, C. (2015). Cognitive psychological training in combination with explosive power training can significantly enhance responsiveness of badminton players. *Journal of Exercise Physiology Online*, 18(4), 1-18.

7. Henjilito, R. (2017). Pengaruh daya ledak otot tungkai, kecepatan reaksi dan motivasi terhadap kecepatan lari jarak pendek 100 meter pada atlet PPLP Provinsi Riau. *Journal Sport Area*, 2(1), 1-19.
8. Johne, M. (2021). The impact of fencing training symmetrisation on simple reaction time. *Biomedical Human Kinetics*, 13(1), 231-236.
9. Kemala, A. (2019). Analisis Start Blok Ditinjau Dari Daya Ledak Dan Kecepatan Reaksi Pada Atlet Lari Jarak Pendek. *Motion: Jurnal Riset Physical Education*, 10(1), 22-31.
10. Laksari, S. A., & Ardy Kusuma, D. (2022). Analisa performa melalui waktu pergerakan menyerang dan reactive strength index. *Jurnal Prestasi Olahraga*, 2022, 26–32.
11. Munawarah, N., Hamid, A., & Warni, H. (2023). Analisis daya ledak otot lengan, daya ledak otot tungkai, kecepatan reaksi, dan ketepatan serangan pada atlet anggar Kabupaten Balangan. *Stabilitas: Jurnal Pendidikan Jasmani dan Olahraga*, 4(1), 62–72.
12. Permana, H., & Suharyana, S. (2013). Pengaruh sirkuit training awal akhir latihan teknik terhadap kardiorespirasi, power, smash, passing bawah atlet bola voli. *Jurnal Keolahragaan*, 1(1), 49–62.
13. Prakosa, M. W. B., Hariyanto, A., & Ismalasari, R. (2021). Pengaruh latihan imagery dan konsentrasi terhadap ketepatan tusukan dalam olahraga anggar. *JOSSAE: Journal of Sport Science and Education*, 6(1), 1–19.
14. Suharno, H. P. (1985). *Alat-alat tes pengukuran kesegaran jasmani*. Jakarta.
15. Supriyoko, A., & Mahardika, W. (2018). Kondisi fisik atlet anggar kota Surakarta. *Jurnal SPORTIF: Jurnal Penelitian Pembelajaran*, 4(2), 280-292.
16. Susanto, S., Setyawan, H., García-Jiménez, J. V., Pavlovic, R., Nowak, A. M., & Susanto, N. (2024). Analysis of one-hole game tools in developing fine motor skills in early childhood. *Sports Science and Health*, 27(5), 135–139.
17. Susanto, S., Setyawan, H., Susanto, N., García-Jiménez, J. V., Latino, F., Tafuri, F., & Eken, Ö. (2024). The influence of modified one-hole game media in improving fine motor skills in early childhood. *Sports Science and Health*, 27(5), 151–156.
18. Susanto, S., Siswantoyo, S., & Sumaryanto, S. (2022). Traditional sport-based physical education learning model in character improvement and critical thinking of elementary school students. *Sports Science and Health*, 24(2), 165–172.
19. Susanto, S., Siswantoyo, S., Prasetyo, Y., & Putranta, H. (2021). The effect of circuit training on physical fitness and archery accuracy in novice athletes. *Physical Activity Review*, 1(9), 100-108.
20. Syaquro, A., Rusdiana, A., & Sumardiyanto. (2017). Comparison of whole body reaction and anticipation reaction time between kata and kumite in karate. *IOP Conference Series: Materials Science and Engineering*, 180(1), 1-3. <https://dx.doi.org/10.1088/1757-899X/180/1/012232>
21. Taufiqi, S. R., & Ismalasari, R. (2023). Analisis Tingkat Pemahaman Olahraga Anggar SMK Negeri 1 Jetis Mojokerto. *Jurnal Prestasi Olahraga*, 6(1), 36-40.
22. Welk, G., Corbin, W., Welk, G., & Corbin, C. (2015). *Concepts of fitness and wellness: A comprehensive lifestyle approach* (Loose-leaf ed.). McGraw-Hill Higher Education.
23. Yudiana, Y., Subardjah, H., & Juliantine, T. (2012). *Latihan fisik*. Bandung.
24. Zulkifli, Z., Mongsidi, W., & Sawali, L. (2019). Hubungan antara kecepatan reaksi dengan kemampuan tendangan sabit beladiri pencak silat pada siswa SMPN 3 Raha. *Jurnal Wahana Kajian Pendidikan IPS*, 3(2), 46–55.

ACKNOWLEDGMENTS

We would like to express our sincere appreciation to the promoter team, fencing coaches, and research participants. This research was funded by the researchers themselves. We would like to thank all parties for the support that has been given in the process of conducting this research.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no external funding.

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