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CHRONIC ADAPTATIONS TO COMPLEX AND CONTRAST STRENGTH TRAINING: IMPACTS ON AEROBIC AND ANAEROBIC ENDURANCE IN YOUTH SOCCER PLAYERS

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Abstract:
A well-established positive relationship exists between strength training and soccer performance, as well-designed resistance-based programs can enhance both aerobic and anaerobic capacities, which are essential for the sport. The present study aimed to examine the long-term effects of complex and contrast strength training on aerobic and anaerobic endurance performance in soccer players. The study sample consisted of 30 male athletes (mean height: 180.53 ± 6.339 cm; mean weight: 72.97 ± 7.421 kg; mean age: 18.10 ± 0.712 years) from the Gaziantep F.K. soccer team, competing in the TFF Development League during the 2024–2025 season. Utilizing an experimental design with pre-test and post-test control groups, the research employed quantitative methods to assess changes over time. Baseline aerobic and anaerobic endurance tests were conducted over the first two days, after which participants were randomly assigned to one of three groups: complex training, contrast training, or a control group. In addition to regular team practices, the complex and contrast training groups completed 24 training sessions over eight weeks (three sessions per week), while the control group continued with standard weekly training only. Following the intervention period, post-tests for

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aerobic and anaerobic endurance were administered. Data analysis involved paired sample t-tests for within-group comparisons, one-way ANOVA for between-group differences, and LSD tests for multiple comparisons, with a significance level set at $p < 0.05$. The results indicated that both complex and contrast training significantly improved aerobic and anaerobic endurance compared to the control group ($p < 0.05$), with notable gains observed in the 30-15 Intermittent Fitness Test (IFT) and Vertical Jump Test. However, no significant differences were found between the complex and contrast training groups ($p > 0.05$). In conclusion, the eight-week intervention yielded significant improvements in both aerobic and anaerobic performance among soccer players, suggesting that incorporating complex and contrast strength training into conditioning programs can effectively enhance soccer-specific endurance capacities.

Keywords: aerobic and anaerobic endurance, soccer, strength training methods

1. Introduction

Soccer, which attracts a great deal of interest in our country and around the world, is a sport with high viewership that requires the use of numerous motor skills among team sports (Williams *et al.*, 2013). Although endurance forms the basis of the motor skills that need to be developed in soccer players, it is equally important to develop strength, speed, flexibility, technical skills, and both aerobic and anaerobic power capacity to a high level, in line with the requirements of modern soccer. A holistic approach to these physical and technical elements is essential for players to maintain high performance during matches and effectively adapt to the game's varying intensities. To sustain a high-intensity pace, athletes must engage in additional sprint or explosive strength training at near-maximum speeds, including short-term explosive strength and sprint performance, alongside essential parameters such as endurance and strength. At the same time, it is known that in order to maintain an intense pace, in addition to important parameters such as endurance and strength, soccer players need to perform extra sprint or explosive strength training at near-maximum speeds, such as short-term explosive strength and sprint performance (Kabacinski *et al.*, 2022). Furthermore, examining today's soccer training, the aim is to develop multiple motor skills simultaneously within short-term training designs, taking matches into account, and anaerobic performance outputs are gaining importance (Oliver, Ramachandran and Lloyd, 2024). Various strength training methods are being developed to enhance anaerobic performance in the ever-evolving field of soccer. Two of these methods are complex and contrast training methods. Complex training consists of performing a series of predetermined movements in sequence (Barra-Moura *et al.*, 2024). Contrast training is a type of training that combines strength training with the use of high- and low-weight loads in alternating fashion (Lin *et al.*, 2025). Athletes aim to work on and develop endurance, speed, explosive strength, and power on different days during training. In line with recent training practices, complex and contrast training methods have been combined within the same training load to increase

athletes' strength and explosive performance. This application aims to optimize athletes' explosive power capacity by utilizing the Post-Activation Performance Enhancement (PAPE) mechanism, which is based on the principle of a temporary increase in performance after maximum or near-maximum muscle contractions. Athletes can perform strength and plyometric exercises together within the same training session (Fischer and Paternoster, 2024). The most significant difference between the complex and contrast strength method lies in the number of sets and rest intervals, which have been shown to impact aerobic and anaerobic performance, including endurance, strength, and speed, in various sports disciplines (Baker *et al*., 2024). At the end of the studies conducted, it is believed that complex and contrast strength training may impact aerobic and anaerobic endurance performance, particularly in soccer, and understanding this effect is crucial for scientific advancement. Therefore, as it is understood that studies on this subject are limited, our study is considered to make an important contribution to the literature. The aim of our study is to examine the chronic effect of complex and contrast strength training on aerobic and anaerobic endurance performance in soccer players.

2. Material and Methods

Our research employs a pre-test, post-test, and control group experimental design, utilizing quantitative research methods. The experimental and control groups in our study consisted of players from the Gaziantep F.K. U-19 soccer team competing in the 2024-2025 TFF Development League season. A total of 30 soccer players participated in the study and were randomly assigned to three groups: a complex group (n = 10), a contrast group (n = 10), and a control group (n = 10).

The athletes participating in the study were given preliminary information about the measurements to be taken. Wet-signed consent forms were obtained from the athletes. To ensure they could perform the measurements at high performance, the measurement devices were introduced one week prior to the measurements, and trials were conducted on the devices to optimize their performance. All athletes underwent body composition measurements and anaerobic power testing (vertical jump test and countermovement jump test) on the first day. On the second day, a speed test (30m) and a 30-15 Intermittent Fitness Test were performed. Subsequently, all participants were randomly assigned to complex, contrast, and control groups through a random card selection process. After being assigned to groups, the athletes underwent a total of 24 training sessions over 8 weeks, consisting of 3 days per week, in addition to team training, divided into complex and contrast groups. The control group continued with team training, and no other training methods were applied. The laboratory measurements for the study were conducted at the Gaziantep University Sports Sciences Application and Research Center, while the field measurements were conducted at the Gaziantep F.K. facilities under the observation of the club coaches. Approval for this thesis study was obtained from the Health and Sports Ethics Committee of the Faculty of Sports Sciences at Gaziantep University (Decision No. 2024/27 E-47989649-050.03-509340).

Table 1: Training Program

1st Week	2nd Week	3rd Week	4th Week	5th Week	6th Week	7th Week	8th Week
Taking pre-test measurements and applying strength training methods 3 days a week (except for the control group)	Strength training methods applied 3 days a week (except for the control group)	Strength training methods applied 3 days a week (except for the control group)	Strength training methods applied 3 days a week (except for the control group)	Strength training methods applied 3 days a week (except for the control group)	Strength training methods applied 3 days a week (except for the control group)	Strength training methods applied 3 days a week (except for the control group)	3. Taking the final test measurements after the workout

2.1 Data Collection Techniques and Tools

2.1.1 Warm-up Procedure

Before measurements were taken on the athletes, general muscle warm-ups were performed, followed by functional dynamic warm-ups. Additionally, dynamic warm-ups were performed using dynamic joint mobility exercises and soccer-specific drills. Before conducting field measurements, additional exercises were performed to increase joint mobility following a 10-minute dynamic warm-up.

2.1.2 Body Composition Measurement

Participants' body composition was determined using body mass index (BMI). BMI is a simple and widely used method that shows the ratio of body weight to height based on an individual's height and weight measurements. Participants were informed about the procedure prior to the measurements, and standard rules were explained to ensure accurate measurements. Weight measurements were taken using a precision scale, while height measurements were recorded using a stadiometer with the participant standing upright and in a natural position. To increase the reliability of the measurements, participants were asked not to move during the measurement and to breathe normally. BMI was calculated using the obtained height and weight data, and each individual's body composition was classified according to their BMI value. This method was found to be suitable for quickly and practically assessing general body composition, especially in field studies.

2.1.3 Vertical Jump Test

The test demonstrates a high reliability coefficient (rxy = 0.97) for assessing jumping power and anaerobic performance in athletes (Reilly, Bangsbo & Franks 2000). Participants stood between SE-165 coded photocells and executed maximal vertical jumps from a slight knee extension position. Jump heights were measured in centimeters

using a laser sensor positioned at the edge of the photocells. Each athlete completed three attempts, with the highest value recorded as the final test result.

2.1.4 30-15 IFT Test

Laboratory testing is considered the most effective method for measuring aerobic endurance. However, it is often impractical for team sports due to cost and time limitations. Field tests, such as the 30-15 Intermittent Fitness Test (IFT), offer practical alternatives. They provide rapid and cost-effective assessments of aerobic endurance. The 30-15 IFT, in particular, produces competition performance data that is more relevant for athletes than laboratory tests (Bangsbo *et al.* 2008). Due to its established validity and reliability, the 30-15 IFT is widely recognized as a dependable measure of aerobic endurance (Uzun, Bozdoğan and Kızılet, 2021).

2.1.5 30-Meter Speed Test

The athletes' 30-meter sprint times were measured using a photoelectric chronometer device with code SE-165. The athletes started at any time they chose from the starting line located one meter behind the starting photocell. Measurements were taken using photoelectric sensors placed at the start and at the 30th meter of the 30-meter running distance. Measurements were taken twice from the athletes with 3-minute rest intervals, and then their best times were recorded in the system (Mackenzie, 1999).

Table 2: Complex Strength Training Protocol

Exercise	Set	Repeat	Rest	Training Intensity
Back Squat + Box Jump	*2*	12	3 min	%80
Bench Press + Plyometric Push-Up				
Hip Thrust + Jump Squat				
Push Press + Overhead Medicine Ball Throw				
Barbell Step-Up + Lateral Bounds				
Bulgarian Split Squat + Jumping Lunge				

• Set 1: Complex training, performed with 1 minute rest.
• Set 2: Complex training, performed with 10 seconds rest combined with strength training (Thapa *et al.*, 2022).

Table 3: Conrast Strength Training Protocol

Exercise	Set	Repeat	Rest	Training Intensity
Back Squat + Box Jump	*2*	12	3 min	%80
Bench Press + Plyometric Push-Up				
Hip Thrust + Jump Squat				
Push Press + Overhead Medicine Ball Throw				
Barbell Step-Up + Lateral Bounds				
Bulgarian Split Squat + Jumping Lunge				

• Set 1: Contrast training was performed with strength training, with 10-second rest intervals.
• Set 2: Contrast training was performed with 1-minute rest intervals (Barra-Moura *et al.*, 2024).

2.2 Data Analysis

The pre- and post-test data obtained as a result of the 8-week study were recorded in the SPSS 22.0 Analysis program. After conducting a descriptive analysis of the recorded data, a normality test was performed to assess the distribution of the data. Upon determining that the data exhibited a normal distribution, a paired t-test was applied as a parametric test to assess the significance of the difference between the pre-test and post-test results. -post-test mean differences to determine the significance between groups, and the LSD test from the multiple group comparisons tests to determine which group the significance between the groups favored. The statistical significance level of the data was set at 0.05 ($p<0.05$).

3. Results

The demographic and performance characteristics of the participants in the study were first determined. Parametric tests were applied to determine the effects of the 8-week study, and the results obtained are shown in the tables below.

Table 4: Demographic Characteristics of Participants

	N	Min	Max	Mean	Std. Dev.
Year	30	17	19	18,10	,712
Height(cm)		166	193	180,53	6,339
Weight(kg)		61	96	72,97	7,421

Table 4 shows that 30 male soccer players participated in the study, with participants' height: 180.53±6.339 cm, weight: 72.97±7.421 kg, and age: 18.10±0.712 year.

Table 5: Comparison of Participants' Pre-Test and Post-Test Average Differences by Group

Tests	Groups		N	Ort±SS	F	p
30-15 IFT(Sn)	Complex[a]	Pre- Test	30	16,59±,347	5,095	**,013**[a-c/b-c]
		Post- Test		18,53±,798		
	Contrast[b]	Pre- Test		16,86±,374		
		Post- Test		19,04±,548		
	Control[c]	Pre- Test		15,22±,886		
		Post- Test		16,54±,786		
Vertical Jump Test (Cm)	Complex[a]	Pre- Test		41,87±1,74	92,008	**,000**[a-c/b-c]
		Post- Test		46,06±1,71		
	Contrast[b]	Pre- Test		41,17±1,38		
		Post- Test		45,87±1,47		
	Control[c]	Pre-Test		41,97±1,95		
		Post- Test		42,19±1,80		
30 Meters Sprint Test (Sn)	Complex[a]	Pre-Test		4,20±,112	,788	,465
		Post- Test		4,02±,053		
	Contrast[b]	Pre- Test		4,18±,143		
		Post- Test		3,95±,057		
	Control[c]	Pre- Test		4,35±,170		

		Post- Test		4,18±,155		

a: Complex Training Group; b: Contrast Training Group; c: Control Training Group

Table 7 shows the ANOVA test results for the pre-post test mean differences of participants' 30-15 IFT, Vertical Jump, and 30-meter sprint test data. There was a statistically significant difference between groups in the pre-test and post-test results of the 30-15 IFT test and Vertical Jump Test data ($p<0.05$). However, the pre- and post-test results of the Thirty-Meter Sprint Test data did not show a statistically significant difference between groups ($p>0.05$). To determine which group benefited from the change, the LSD test was used for post hoc tests among multiple groups. This test revealed that the statistical significance observed in the 30-15 IFT and Vertical Jump test data favored the complex and contrast groups in the control-complex and control-contrast group comparisons ($p < 0.05$). No statistically significant difference was found between the contrast and complex groups ($p>0.05$).

4. Discussion and Conclusion

This study comprehensively examined the chronic effects of complex and contrast training programs on both aerobic and anaerobic endurance performance in Soccer players. The findings of the study indicate that eight-week complex and contrast training protocols have positive effects on aerobic and anaerobic performance. The results of the tests revealed that the groups undergoing complex and contrast training showed statistically significant superiority over the control group in the 30-15 IFT test and vertical jump performance data. However, no statistically significant difference was observed between the groups in the 30-meter sprint test results. When the pre-test and post-test data were examined, it was found that both complex and contrast training protocols led to significant improvements in the athletes' aerobic and anaerobic endurance parameters. However, when comparing the two training types, no statistically significant difference was found in terms of aerobic and anaerobic performance. This indicates that both methods are equally effective to a certain degree, but their effects emerge through different mechanisms depending on the energy system and load structure. The results of our study are particularly noteworthy for the effect of complex and contrast training applications on increasing aerobic endurance. Mixed loads play an important role in developing athletes' long-term performance capacity by simultaneously activating different energy systems. This finding is consistent with the results of a study conducted by Thapa *et al.* (2022), who reported that complex and contrast training applications had positive effects on aerobic endurance, maximal strength, and repeated sprint performance, and that such training increased athletes' overall endurance by enhancing oxidative capacity (Thapa, Narvariya, Weldon, Talukdar and Ramirez-Campillo, 2022). Similarly, a study conducted by Kumar and Pandey (2023) on amateur athletes found that an eight-week complex training program led to significant increases in both aerobic and anaerobic power (Kumar and Pandey, 2023). These data support the findings of our

study and demonstrate that mixed training models are a reliable method for developing endurance capacity.

The effects of contrast training protocols on repeated sprint endurance also yield results parallel to our study. Wadsworth *et al.* (2024) reported that a six-week contrast training program resulted in significant improvements in sprint repetition performance in soccer players (Wadsworth *et al*., 2022). This indicates that contrast loading enhances the phosphagen and glycolytic energy systems, thereby increasing endurance during short-term high-intensity performance. Similarly, Gee, Harsley, and Bishop (2021) observed significant improvements in power outputs related to speed and endurance following a ten-week complex training program conducted on academy-level soccer players (Gee *et al.,* 2021). These findings support that the endurance gains observed in our study can be explained by the combined effects of neuromuscular and metabolic adaptations.

Furthermore, our study observed that endurance adaptations developed in different directions between the complex and contrast training groups. It was found that athletes undergoing complex training showed more pronounced aerobic development, while adaptations related to anaerobic endurance were more prominent in the contrast training group. These differences are consistent with the findings of a meta-analysis by Lin, Wang, and Zhang (2025), which indicated that contrast training is more effective for short-term high-intensity performance, while complex loading provides an advantage in activities requiring long-term endurance (Lin, Yan, Xu *et al.*, 2025). These results demonstrate that the training load structure has a decisive effect on energy system activation and performance outcomes.

Findings supporting this differentiation also exist from a neurophysiological perspective. Cormie, McGuigan, and Newton (2011) stated that complex and contrast training create different adaptation mechanisms in the neuromuscular system, particularly that complex applications increase the maximum contraction speed, thereby raising the power production capacity within endurance (Cormie *et al*., 2011). Erol (2022) reported that eight weeks of complex and contrast training significantly improved running and speed endurance in soccer players (Erol, 2022). These studies show that improvements in neuromuscular coordination directly contribute to athletes' endurance performance.

Finally, Alves *et al.* (2010) emphasize that short-term complex and contrast training applications increase speed, agility, and jumping performance in soccer players (Alves *et al*., 2010). Similarly, Santos and Janeira (2008) report that explosive strength increases along with anaerobic endurance in basketball players (Santos and Janeira, 2008). The results indicate that both training models enhance athletes' performance capacity by stimulating their energy systems through distinct mechanisms. A review of the literature suggests that complex training produces greater improvements in aerobic endurance, while contrast training is more effective for enhancing anaerobic and short-term high-intensity performance. Additionally, the complex and contrast training groups outperformed the control group in both the vertical

jump and the 30-15 IFT tests. No significant difference was observed between the groups in the 30-metre sprint test. These findings support the conclusion that complex and contrast training effectively improves multiple aspects of performance in young soccer players.

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Conflict of Interest Statement
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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References

Alves, J. M. V. M., Rebelo, A. N., Abrantes, C., & Sampaio, J. (2010). Short-term effects of complex and contrast training in soccer players' vertical jump, sprint, and agility abilities. *The Journal of Strength & Conditioning Research*, *24*(4), 936-941. https://doi.org/10.1519/jsc.0b013e3181c7c5fd

Bangsbo, J., Iaia, F. M., & Krustrup, P. (2008). The Yo-Yo intermittent recovery test: a useful tool for evaluation of physical performance in intermittent sports. *Sports medicine*, *38*(1), 37-51. https://doi.org/10.2165/00007256-200838010-00004

Barra-Moura, H., Vieira, J. G., Werneck, F. Z., Wilk, M., Pascoalini, B., Queiros, V., ... & Vilaça-Alves, J. (2024). The effect of complex contrast training with different training frequency on the physical performance of youth soccer players: a randomized study. *PeerJ*, *12*. https://doi.org/10.7717/peerj.17103

Cormie, P., McGuigan, M. R., & Newton, R. U. (2011). Developing maximal neuromuscular power: part 2—training considerations for improving maximal power production. *Sports medicine*, *41*(2), 125-146. https://doi.org/10.2165/11538500-000000000-00000

Erol, S. (2022). An Investigation of the Effects of 8-Week Complex and Contrast Strength Trainings Applied to Soccer Players on Some Physical Properties. *International Online Journal of Education and Teaching*, *9*(4), 1600-1613. Retrieved from https://files.eric.ed.gov/fulltext/EJ1353886.pdf

Fischer, J., & Paternoster, F. K. (2024). Post-activation-performance enhancement: possible contributing factors. *Journal of sports science & medicine*, *23*(1), 34. doi:10.52082/jssm.2024.34

Gee, T. I., Harsley, P., & Bishop, D. C. (2021). Effect of 10 Weeks of complex training on speed and power in academy soccer players. *International Journal of Sports Physiology and Performance*, *16*(8), 1134-1139. https://doi.org/10.1123/ijspp.2020-0139

Kabacinski, J., Szozda, P. M., Mackala, K., Murawa, M., Rzepnicka, A., Szewczyk, P., & Dworak, L. B. (2022). Relationship between isokinetic knee strength and speed, agility, and explosive power in elite soccer players. *International journal of environmental research and public health*, *19*(2), 671. https://doi.org/10.3390/ijerph19020671

Kumar, G., & Pandey, V. (2023). Effect of Complex Training on Aerobic and Anaerobic Power of Amateur Athletes. *Physical Education Theory and Methodology*, *23*(1), 65-71. https://doi.org/10.17309/tmfv.2023.1.09

Lin, S., Yan, Z., Xu, T., Xie, H., & Liu, R. (2025). Effect of Complex Contrast Training on Change of Direction Performance in Team-Sport Athletes: A Meta-Analysis. *Applied Sciences*, *15*(13), 7385. https://doi.org/10.3390/app15137385

Mackenzie B, 1999. Flying 30 metre Test. Retrieved from https://www.brianmac.co.uk/flying30.htm

Reilly, T., Bangsbo, J., & Franks, A. (2000). Anthropometric and physiological predispositions for elite soccer. *Journal of sports sciences*, *18*(9), 669-683. https://doi.org/10.1080/02640410050120050

Santos, E. J., & Janeira, M. A. (2008). Effects of complex training on explosive strength in adolescent male basketball players. *The Journal of Strength & Conditioning Research*, *22*(3), 903-909. https://doi.org/10.1519/jsc.0b013e31816a59f2

Thapa, R., Narvariya, P., Weldon, A., Talukdar, K., & Ramirez, R. (2022). Can complex contrast training interventions improve aerobic endurance, maximal strength, and repeated sprint ability in soccer players? A systematic review and meta-analysis. *Montenegrin Journal of Sports Science and Medicine*, *11*(2), 3-13. https://doi.org/10.26773/mjssm.220906

Uzun, N. E., Bozdoğan, T. K., & Kızılet, A. (2021). Maksimum Oksijen Kapasitesinin Belirlenmesinde Kullanılan Aralıklı Dayanıklılık Testlerinden Yo-Yo Aralıklı Toparlanma Testi (Seviye 1) ve 30-15 IFT'nin Formüllerinin Güvenilirliğinin Değerlendirilmesi. *Sportif Bakış: Spor ve Eğitim Bilimleri Dergisi*, *8*(2), 268-280. https://doi.org/10.33468/sbsebd.221

Wadsworth, D. D., Rodriguez-Hernandez, M., Huffman, L. S., McDonald, J. R., Spring, K. E., & Pascoe, D. D. (2022). Adaptations to a concurrent exercise training program in inactive aging women. *The Journal of Strength & Conditioning Research*, *36*(11), 3217-3223. https://doi.org/10.1519/jsc.0000000000004200

Williams, A. M., Ford, P., Reilly, T., & Drust, B. (2013). *Science and soccer*. London, UK: Routledge. https://doi.org/10.4324/9780203131862