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The Effect of Offset Strength Training Applied to the Lower Extremities on Balance Performance in Football Players

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Abstract

This study examines the effect of offset strength training on balance performance among football players, suggesting that this training method can significantly improve balance compared to traditional training techniques. The research involved a six-week programme with twenty participants divided into a performance group and a control group, each consisting of ten male football players with typical performance levels. The performance group participated in regular team training alongside offset strength training (OST) conducted biweekly, while the control group followed their usual training routine. Balance performance was assessed using the Single Leg Range of Stability (SLRS), Single Leg Land and Hold (SLLH), Single Leg Stand (SLS), and Single Leg Squat (SLSq) tests. Statistical analyses compared balance scores before and after the intervention. Results showed a statistically significant improvement in balance performance for the performance group compared to the control group ($p \leq 0.05$). These findings support previous research indicating that offset training can enhance balance performance. The results indicate that offset strength training effectively improves balance and reduces muscle imbalances in male football players. This method offers a valuable alternative to traditional bilateral strength exercises, providing a potentially more varied training approach.

Keywords: Offset strength training, Balance performance, Footballers

Introduction

Football is one of the most popular sports globally, characterized by numerous physical and technical factors that significantly influence players' performance (Manolopoulos et al., 2016). Among these factors, balance performance is paramount (Dello Iacono et al., 2016; Hammami et al., 2018; Manolopoulos et al., 2016). Balance directly affects a player's mobility, speed, and agility, thereby enhancing their overall gameplay performance (Keller et al., 2024; Muehlbauer et al., 2019; Park et al., 2024).

It is important to note that balance encompasses not only the ability to maintain a static position but also the capacity to control body weight during dynamic movements. Consequently, balance training plays a critical role in the training regimens of football players (Park et al., 2024; Sharp et al., 2023). An optimal balanced body position is vital for executing fundamental football skills, including dribbling, passing, shooting, and defending (Cè et al., 2018; Souglis et al., 2023). Particularly, balance is one of the most critical determinants of player performance during sudden directional changes, jumping, and running. A loss of balance can result in decreased performance and an increased risk of injury (Cè et al., 2018; Muehlbauer et al., 2019; Sharp et al., 2023; Zago et al., 2020). In this context, the systematic incorporation of balance training can aid players in enhancing their performance while simultaneously mitigating the risk of injury (Collings et al., 2024; Dello Iacono et al., 2016; Zago et al., 2020).

In recent years, the offset force method has gained recognition as an effective approach for enhancing balance performance and reducing injury risk among athletes (Park et al., 2024; Sharp et al., 2023; Souglis et al., 2023). This method involves exercises that apply asymmetrical forces to different sides of the body (Dello Iacono et al., 2016; Hammami et al., 2018; Muehlbauer et al., 2019), facilitating the development of balance and stabilization abilities. The benefits of such training are particularly pronounced in sports characterized by rapid and variable movements, such as football (Cè et al., 2018; Park et al., 2024; Zago et al., 2020).The offset force method emphasizes the asymmetric functioning of muscle groups rather than symmetrical engagement (Jarosz et al., 2020; Keller et al., 2024; Sharp et al., 2023). For example, scenarios in which one leg must exert greater force to stabilize the other leg contribute to maintaining balance (Erdem & Akyüz, 2017). This training enhances the proprioceptive feedback mechanisms essential for sustaining balance (Souglis et al., 2023). Proprioception is a system that facilitates the perception of the body's position, movement, and balance, which is critically important for football players in controlling rapid and unexpected movements on the field (Chaabene & Negra, 2017; Erdem & Akyüz, 2017; Souglis et al., 2023).

Previous research has demonstrated that the offset force method positively influences athletes' balance performance (Cè et al., 2018; Chaabene & Negra, 2017; Sharp et al., 2023). For instance, groups participating in this type of training have shown significant improvements in balance test results (Chaouachi et al., 2017). Additionally, reductions in injury rates and enhancements in overall physical performance have been reported (Ramírez-Campillo et al., 2015).

Material and Method

Ethics Committee Permission

At the beginning of the study, approval was obtained from the Ethics Committee of the Faculty of Health Sciences at Manisa Celal Bayar University document number: 30.10.2024 (20.478.486/ 2684), and participants completed a voluntary consent form.

This study involved 20 volunteer football players, aged 18 years and older, actively licensed by the Turkish Football Federation. Based on the preliminary test results, participants were randomly assigned to the performance group (n=10) and the control group (n=10). The design of this study can be classified as an experimental design. The average age of the performance group was 18.52 ± 0.55 years, with an average height of 180.35 ± 121,24 cm and an average weight of 75.41 ± 12,19 kg. In contrast, the control group had an average age of 18.51 ± 0.94 years, an average height of 178.50 ± 10,99 cm, and an average weight of 72.18 ± 10.40 kg.

Figure 1. Performance Group's 6-Week Training Program

All participants engaged in a structured training program for six weeks, training twice a week in addition to their team training, with each session lasting a total of 60 minutes. Each training session comprised 10 minutes of dynamic warm-ups, 45 minutes of the main training phase, and 5 minutes of static stretching exercises. The control group continued with their team training during this period but did not participate in any additional training sessions, thus remaining inactive compared to the performance group. At the outset of the study, the maximum strength weights of the athletes were determined using a repeated measures method. The training program designed for the performance group was evaluated by expert coaches in the field and subsequently adjusted based on their feedback. This program included a 2.5% increase or decrease in unilateral strength. For the first two weeks, the weights corresponded to 30% of the established maximum strength, while in weeks 3 and 4, this increased to 35%, and in weeks 5 and 6, it reached 40% of the maximum strength (Jarosz et al., 2020).

Weeks	Exercises	Set&Rep
1-2	Offset Barbell Squat	3x6
	Offset Hip Thrust	3x6
	Offset One-Leg Bridge	3x6
	Offset Barbell Calf Raise	3x6
	Offset Romain Deadlift	3x6
	Offset Side Lunge	3x6
	Offset Lunge	3x6
3-4	Offset Barbell Squat	3x8
	Offset Hip Thrust	3x8
	Offset One-Leg Bridge	3x8
	Offset Barbell Calf Raise	3x8
	Offset Romain Deadlift	3x8
	Offset Side Lunge	3x8
	Offset Lunge	3x8
5-6	Offset Barbell Squat	3x10
	Offset Hip Thrust	3x10
	Offset One-Leg Bridge	3x10
	Offset Barbell Calf Raise	3x10
	Offset Romain Deadlift	3x10
	Offset Side Lunge	3x10
	Offset Lunge	3x10

Data Collection Tools

The ForceDecks measurement device, supported by artificial intelligence (AI) and developed by Vald Performance, was used to evaluate the performance of individuals in all groups. Each athlete underwent three trials, and the best performance value was recorded.

ForceDecks Test: Single Leg Range of Stability Test

Each athlete performed three trials, with the best performance being recorded. While standing on one leg on the ForceDecks platform, the athlete dynamically shifted their center of pressure (COP) in four directions (anterior, posterior, medial, and lateral) to the limits of stability while maintaining balance. The test was terminated upon stepping, excessive trunk movement, or loss of balance. Stability metrics, including directional control and maximum COP displacement, were analyzed (Collings et al., 2024).

ForceDecks Test: Single Leg Land and Hold Test Protocol

Each athlete performed three trials, with the best performance value being recorded. In the starting position, the athlete stood with hands on the hips and feet shoulder-width apart, preparing to jump onto a 30 cm high landing area. The movement was performed by landing softly on the ForceDecks platform on one leg, and the test was terminated upon loss of balance (Collings et al., 2024).

ForceDecks Test: Single Leg Stand Test Protocol

Each athlete performed three trials, with the best performance value being recorded. With hands on the hips, the athlete performed a squat movement on one leg from an upright position to a self-selected depth while maintaining stability. The test was terminated upon loss of balance, heel lift, or excessive trunk flexion. Ground reaction forces and squat depth were recorded for analysis (Collings et al., 2024).

Single Leg Squat Test Protocol

Each athlete performed three trials, with the best performance value being recorded. With hands on the hips, the athlete performed a squat movement on one leg in the starting position. The test was terminated upon loss of balance (Collings et al., 2024).

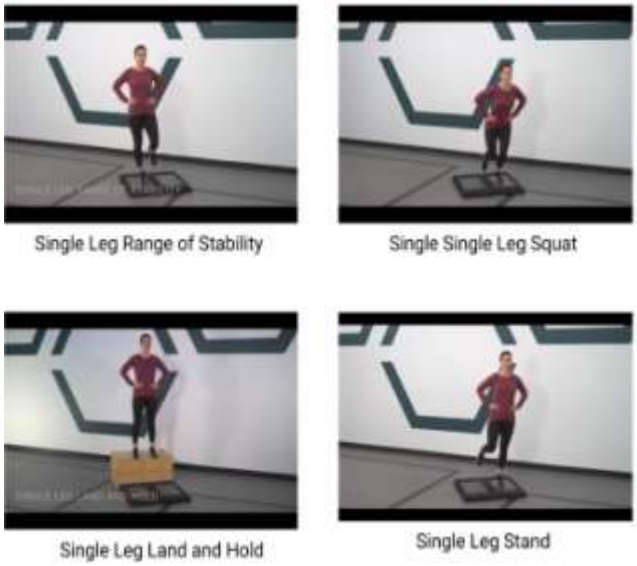

Figure 2. Vald Foredecks Balance Performance Tests

Statistical Analysis

Statistical analysis of the data in our study was performed using the SPSS 25.0 software package. The normality of the data distribution was assessed using the Shapiro-Wilk test. A dependent samples t-test was employed to analyses the differences between pre-test and post-test scores within each group. An independent samples t-test was used to evaluate the

differences between groups. The significance level of ($p \leq 0.05$) was considered statistically significant.

Findings

Table 1. Comparison of Pre-test and Post-test Findings of Performance and Control Groups.

($p \leq 0,05$)

According to Table 2, the intra-group performance measurements indicated that significant differences were found between the pre-test and post-test results of the performance group ($p \leq 0,05$). However, no significant differences were observed in the test results of the control group ($p \geq 0,05$).

Tests	Groups	N	Pre-test (M ± SD)	Post-test (M ± SD)	df	t	p
Single Leg Land and Hold	Control	10	15.0 ± 3.0	15.5 ± 3.2	18	2.87	**0.001**
	Performance	10	14.0 ± 2,8	19.0 ± 2.5			
Single Leg Range of Stability	Control	10	12.0 ± 2,5	12.5 ± 2.4	18	7.32	**0.001**
	Performance	10	11.0 ± 2.0	16.0 ± 1.8			
Single Leg Stand	Control	10	10.0 ± 1.5	10.3 ± 1.4	18	8.24	**0.001**
	Performance	10	9.0 ± 1.2	14.0 ± 1.0			
Single Leg Squat	Control	10	8.0 ± 2.2	8.5 ± 2.1	18	7.90	**0.001**
	Performance	10	7.0 ± 1.8	13.0 ± 1.5			

Table 2. Intragroup Pre-test and Post-test Findigs of Performance and Control Groups.

Tests	Groups	N	Pre-test (M ± SD)	Post-test (M ± SD)	t	p
Single Leg Land and Hold	Control	10	15.0 ± 3.5	15.2 ± 3.4	0.54	0.60
	Performance	10	14.5 ± 3.2	20.0 ± 2.6	5.67	**0.001**
Single Leg Range of Stability	Control	10	12.0 ± 2.4	12.2 ± 2.3	0.45	0.66
	Performance	10	11.5 ± 2.1	18.5 ± 2.2	6.12	**0.001**
Single Leg Stand	Control	10	10.0 ± 1.8	10.1 ± 1.7	0.33	0.74
	Performance	10	9.5 ± 1.6	15.0 ± 1.4	7.21	**0.001**
Single Leg Squat	Control	10	8.0 ± 2.0	8.2 ± 1.9	0.52	0.61

	Performance	10	7.5 ± 1.9	14.0 ± 1.7	6.74	**0.001**

($p \leq 0.05$)

Figure 3. Control and Performance Groups Pre and Post-test Graphs

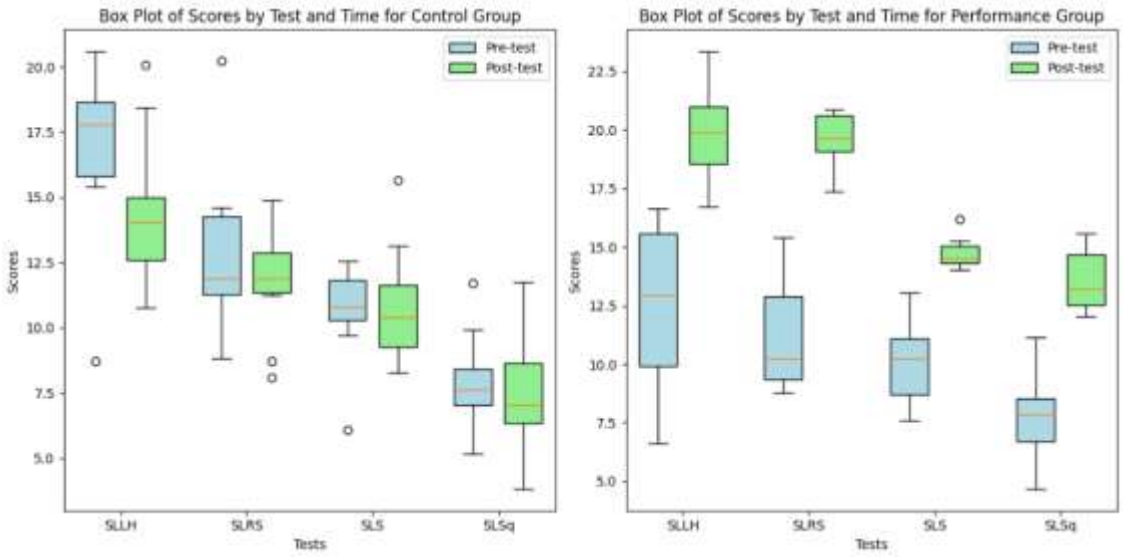

Figure 3. Control and Performance Groups Pre and Post-test Graphs

Discussion and Conclusion

This study aimed to investigate the impact of the offset training method on balance performance in football players. The results indicate that the performance group. which participated in the six-week training program. demonstrated a statistically significant improvement in balance performance compared to the control group.

Previous research has primarily focused on addressing imbalances in strength training methodologies. Within this context. there has been a preference for free weights over machines. dumbbells instead of barbells. and unilateral exercises rather than bilateral ones. Evidence suggests that. despite utilizing lower external loads compared to traditional approaches. these alternative methods significantly enhance the muscle activity of primary muscle groups involved in specific strength exercises (Ramírez-Campillo et al.. 2015). For instance. Muehlbauer et al. (2019) found that the offset training method effectively improved balance performance in young football players. Similarly. Ottinger et al. (2023) reported significant differences in squat performance between groups using the offset strength program and those employing traditional strength methods. Additionally. a study by Nebigh et al. (2022) on handball players revealed that eccentric strength training utilizing the offset method significantly enhanced dynamic balance performance.

Jarosz et al. (2020) examined the asymmetric development of the bench press exercise using the offset method. concluding that the performance group exhibited significant increases in bilateral muscle strength and upper extremity muscle balance compared to the control group. These findings are consistent with the improvements observed in our performance group following the implementation of offset strength training.

Additionally. Lee et al. (2018) explored the differences in muscle imbalances resulting from bilateral versus unilateral exercises performed on the lower extremities. Their findings indicated that unilateral exercises led to more substantial improvements in muscle balance

compared to bilateral exercises. supporting the results found in our study. particularly concerning the performance group.

Pisz et al. (2024) conducted a study on female softball players and observed a significant enhancement in deep balance performance among the group utilizing the offset method for the lower extremities. in contrast to the control group. Furthermore. Saeterbakken and Fimland (2012) noted that standing unilateral shoulder exercises produced more pronounced results in correcting intermuscular imbalances compared to seated bilateral shoulder exercises.

In summary. these findings suggest that incorporating the offset training method during bilateral strength exercises can effectively reduce muscle imbalances while enhancing performance on both sides of the body. This approach offers a practical solution for athletes seeking to improve their overall balance and performance. while also contributing to the broader literature on strength training methodologies.

In conclusion. the findings of this study highlight the significant potential of offset training methods in enhancing balance performance among football players. This approach not only addresses muscle imbalances but also optimises performance in a sport where balance is crucial. By integrating offset training into their programs. athletes can improve their overall gameplay. which is essential for executing fundamental skills effectively. Future research should further investigate diverse training modalities and their specific impacts on balance and performance. thereby providing more comprehensive guidelines for athletes and coaches in the football domain.

REFERENCES

Cè. E.. Longo. S.. Paleari. E.. Riboli. A.. Limonta. E.. Rampichini. S.. Coratella. G.. & Esposito. F. (2018). Evidence of balance training-induced improvement in soccer-specific skills in U11 soccer players. *Scandinavian Journal of Medicine & Science in Sports*. *28*(11). 2443–2456.

Chaabene. H.. & Negra. Y. (2017). The effect of plyometric training volume on athletic performance in prepubertal male soccer players. *International Journal of Sports Physiology and Performance*. *12*(9). 1205–1211.

Chaouachi. M.. Granacher. U.. Makhlouf. I.. Hammami. R.. Behm. D. G.. & Chaouachi. A. (2017). Within session sequence of balance and plyometric exercises does not affect training adaptations with youth soccer athletes. *Journal of Sports Science & Medicine*. *16*(1). 125.

Collings. T. J.. Lima. Y. L.. Dutaillis. B.. & Bourne. M. N. (2024). Concurrent validity and test–retest reliability of VALD ForceDecks' strength. balance. and movement assessment tests. *Journal of Science and Medicine in Sport*.

Dello Iacono. A.. Padulo. J.. & Ayalon. M. (2016). Core stability training on lower limb balance strength. *Journal of Sports Sciences*. *34*(7). 671–678.

Erdem. K.. & Akyüz. C. (2017). The effect of core and balance training on single-leg sway parameters and well-directed kick of male soccer players. *European Journal of Physical Education and Sport Science*.

Hammami. M.. Negra. Y.. Billaut. F.. Hermassi. S.. Shephard. R. J.. & Chelly. M. S. (2018). Effects of lower-limb strength training on agility. repeated sprinting with changes of direction. leg peak power. and neuromuscular adaptations of soccer players. *The Journal of Strength & Conditioning Research*. *32*(1). 37–47.

Jarosz. J.. Gołaś. A.. Krzysztofik. M.. Matykiewicz. P.. Strońska. K.. Zając. A.. & Maszczyk. A. (2020). Changes in muscle pattern activity during the asymmetric flat bench press (offset training). *International Journal of Environmental Research and Public Health*. *17*(11). 3912.

Keller. M.. Lichtenstein. E.. Roth. R.. & Faude. O. (2024). Balance Training Under Fatigue: A Randomized Controlled Trial on the Effect of Fatigue on Adaptations to Balance Training. *The Journal of Strength & Conditioning Research*. *38*(2). 297–305.

Lee. H. T.. Kim. Y. J.. & Kim. Y. S. (2018). Effects of unilateral. bilateral movement and combined exercise using a ski simulator on lower limb joint and muscle activities. *Science & Sports*. *33*(3). 176–182.

Manolopoulos. K.. Gissis. I.. Galazoulas. C.. Manolopoulos. E.. Patikas. D.. Gollhofer. A.. & Kotzamanidis. C. (2016). Effect of combined sensorimotor-resistance training on strength. balance. and jumping performance of soccer players. *The Journal of Strength & Conditioning Research*. *30*(1). 53–59.

Muehlbauer. T.. Wagner. V.. Brueckner. D.. Schedler. S.. Schwiertz. G.. Kiss. R.. & Hagen. M. (2019). Effects of a blocked versus an alternated sequence of balance and plyometric training on physical performance in youth soccer players. *BMC Sports Science. Medicine and Rehabilitation*. *11*. 1–9.

Nebigh. A.. Hammami. R.. Kasmi. S.. Rebai. H.. Drury. B.. Chtara. M.. & van den Tillaar. R. (2022). The influence of maturity status on dynamic balance following 6 weeks of eccentric

hamstring training in youth male handball players. *International Journal of Environmental Research and Public Health*. *19*(15). 9775.

Ottinger. C. R.. Tufano. J. J.. Cochrane-Snyman. K. C.. Gheith. R. H.. & McBride. J. M. (2023). Offset Loading in a Bilateral Squatting Movement Pattern Influences Ground-Reaction Force and Muscle Activity in the Dominant and Nondominant Limb. *International Journal of Sports Physiology and Performance*. *18*(5). 523–529.

Park. H. S.. Oh. J. K.. Kim. J. Y.. & Yoon. J. H. (2024). The Effect of Strength and Balance Training on Kinesiophobia. Ankle Instability. Function. and Performance in Elite Adolescent Soccer Players with Functional Ankle Instability: A Prospective Cluster Randomized Controlled Trial. *Journal of Sports Science & Medicine*. *23*(1). 593.

Pisz. A.. Blažek. D.. Jebavý. R.. & Šťastný. P. (n.d.). *Asymmetry in strength training: investigating the impact of offset training on the deep stabilisation system. strength/performance. and maximal power in Female Softball Players. Hum Mov. 2024; 25 (3): 19–30.*

Ramírez-Campillo. R.. Gallardo. F.. Henriquez-Olguín. C.. Meylan. C. M. P.. Martínez. C.. Álvarez. C.. Caniuqueo. A.. Cadore. E. L.. & Izquierdo. M. (2015). Effect of vertical. horizontal. and combined plyometric training on explosive. balance. and endurance performance of young soccer players. *The Journal of Strength & Conditioning Research*. *29*(7). 1784–1795.

Saeterbakken. A. H.. & Fimland. M. S. (2012). Muscle activity of the core during bilateral. unilateral. seated and standing resistance exercise. *European Journal of Applied Physiology*. *112*. 1671–1678.

Sharp. M.. Ottinger. C.. Gheith. R.. Stefan. M.. Lowery. R.. LoDuca. S.. & Wilson. J. (2023). The Effects of Offset Loading Versus Traditional Loading in the Bench Press Exercise on Muscle Thickness and Strength in Trained Males. *Journal of Science in Sport and Exercise*. *5*(4). 302–313.

Souglis. A. G.. Travlos. A. K.. & Andronikos. G. (2023). The effect of proprioceptive training on technical soccer skills in female soccer. *International Journal of Sports Science & Coaching*. *18*(3). 748–760.

Zago. M.. Moorhead. A. P.. Bertozzi. F.. Sforza. C.. Tarabini. M.. & Galli. M. (2020). Maturity offset affects standing postural control in youth male soccer players. *Journal of Biomechanics*. *99*. 109523.