



The Effect of a Six-Week Intervention Using Small-Sided Games (SSG), Ladder Drill, and Dynamic Balance on Agility of Young Futsal Players

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Abstract

Objectives. This study aimed to compare the effects of small-sided games (SSG) and ladder drills (LD) on agility performance in futsal players with different levels of dynamic balance (DB), which was examined as a moderating variable.

Materials and Methods. Twenty-four male futsal athletes (mean age: 17.1 ± 0.8 years) were randomly assigned to either SSG or LD training groups and further classified into high or low DB levels, forming four experimental subgroups. Over a 6-week intervention (3 sessions/week), participants underwent agility-specific training, and agility was assessed using the Illinois Agility Test. Dynamic balance was measured via the Y Balance Test. A two-way ANOVA with Tukey's post hoc test ($p < 0.05$) was used to assess main and interaction effects.

Results. Both training interventions produced significant improvements in agility ($p < 0.05$). Players with high DB showed the most substantial gains following SSG (21.5% improvement), whereas those with low DB benefited more from LD training (11.0% improvement). A significant interaction was observed between training type and DB level, suggesting that agility adaptations depend on athletes' balance proficiency.

Conclusions. The effectiveness of agility training in futsal players is moderated by individual dynamic balance capacity. SSG is particularly beneficial for players with high DB due to its game-representative movement demands, while LD training provides structured improvements for players with low DB. These findings support the implementation of personalised training strategies based on neuromuscular profiles to optimise agility development in futsal.

Keywords: small-sided games, ladder drill, dynamic balance, agility, futsal.

Introduction

Futsal is a small-sided variant of football that requires a deep understanding of tactical elements, including attack, defence, and transition play (Fahrudin et al., 2024). Played on a reduced field, typically ranging from 25 to 42 meters in

length and 15 to 25 meters in width, the game is fast-paced and high-intensity (Guerra Echevarria & Valencia Sánchez, 2022; Taufik et al., 2021). The compact playing area creates constant pressure from opponents, demanding explosive actions like sprints, accelerations, decelerations, and sharp directional changes (Borges et al., 2021; Tanyeri & Öncen, 2020). Most actions last under 20 seconds, requiring quick decisions, rapid execution, and efficient recovery between efforts (Caetano et al., 2015; Oliveira et al., 2013).

Futsal players must be technically skilled and physically fit to move swiftly and adapt (Pauli et al., 2024; Selin et

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al., 2024). Fitness helps execute technical and tactical plans, improving competitiveness (Bompa & Buzzichelli, 2015; Fitriani et al., 2023; Naser et al., 2017). Players must be agile enough to change direction fast in high-pressure futsal games with little space (Ilham et al., 2024; Rozi et al., 2023). Agility is the ability to change direction quickly while maintaining equilibrium (Pereira et al., 2018; X. Wang et al., 2024). Agility involves rapid directional and speed changes, physical ability, technical execution, and cognitive processing (Ilham et al., 2024; Nygaard Falch et al., 2019). Teaching players' agility is crucial to sports performance (Afonso et al., 2020; Sattler et al., 2015). Athletic development requires a holistic approach that accommodates varied training loads that impact performance and team success (Guntoro et al., 2023; Serrano et al., 2020). Thus, agility training should be routinely included to improve performance (Rozi et al., 2023; Setiawan et al., 2017). Agility is improved through small-sided games and ladder drills by enhancing motor function, neuromuscular control, coordination, and reducing the risk of injury (Afonso et al., 2020; Suryadi et al., 2023; Young & Rogers, 2014).

Small-sided games simulate actual practice situations by changing field size, number of players, goals, ball-touch constraints, and vocal instructions, making them more intense and challenging (Arslan et al., 2022; Theocharis et al., 2023). In real play, players must make quick decisions, adapt to changing situations, and communicate directly with colleagues and opponents (Arslan et al., 2021). Specific, game-like movements in small-sided games improve general motor skills. They also cause neuromuscular and metabolic stress, elevating heart rate to above 80% of maximum (Arslan et al., 2020; Clemente, Ramirez-Campillo, et al., 2021). Ladder drills teach athletes to synchronise quick steps, manage body motions, and maintain balance during rapid directional adjustments (Koestanto et al., 2017; Padrón-Cabo et al., 2020). Ladder drills are used to train speed, coordination, balance, and agility in individuals of all ages, genders, and sports (Sari et al., 2024; Selviani et al., 2025; Wahyono et al., 2024). This training emphasises rhythm, timing, and fine motor control to optimise reactive and anticipatory movement techniques in competitive contexts (Bassa et al., 2024).

Agility requires balance, quickness, and explosive force; agility performance encompasses acceleration and deceleration, and balance is crucial during quick directional shifts following a sequence of actions (Gidu et al., 2022; Sun et al., 2025). Balance is essential in athletics, allowing directional shifts, quick accelerations and decelerations, object manipulation, and body positions (Ahmed et al., 2022; Szabo et al., 2020). Balance is the ability to maintain the centre of gravity within the base of support during both static and dynamic activities (Lesinski et al., 2015; Sari et al., 2025). Dynamic balance involves complex proprioception and range of motion to maintain a steady posture during movement (Hammami et al., 2022; Ozmen, 2016; Sari et al., 2023).

Balance is known to affect agility, but few studies have examined its impact on specific types of training, such as ladder skills and small-sided games. It's still unclear whether these methods work differently for athletes with varying degrees of dynamic balance. Tailoring training to an athlete's physical profile can improve agility, enhance performance,

and reduce the risk of injury. This study aims to examine the effects of ladder and small-sided game training on the agility of futsal players, considering dynamic balance as a moderating factor—this forms the core of the research aim.

Materials and Methods

Research Design

This study utilised a 2×2 factorial design to examine the effects of small-sided games and ladder drills on agility in futsal players, with dynamic balance considered as a moderating variable. This experimental approach allowed for the analysis of both the main effects and interaction effects between training type and dynamic balance on agility outcomes. Participants were randomly assigned to one of four groups to ensure balanced conditions across the intervention.

The training program lasted six weeks, during which standardised exercise protocols were implemented under the supervision of certified trainers. To control for confounding variables, all participants were instructed to maintain their usual dietary habits and refrain from additional high-intensity physical activity throughout the study period.

Table 1. The number of participants in each treatment group.

Dynamic Balance (B)	Agility Training (A)				Total (n)
	SSG (A1)	n	LD (A2)	n	
High (B1)	A1B1	6	A2B1	6	12
Low (B2)	A1B2	6	A2B2	6	12
Total	A1	12	A2	12	24

Notes: SSG = Small Side Games, LD = ladder drill

Participants

The study involved 46 futsal players from Vamos Academy in Padang. Based on body mass index (BMI) percentiles, the top and bottom 27% were selected to represent contrasting levels of dynamic balance, resulting in the inclusion of 12 participants with high dynamic balance and 12 with low dynamic balance. Thus, a total of 24 male futsal players (mean age: 17.2 ± 0.76 years; height: 166.8 ± 5.4 cm; weight: 59.8 ± 7.4 kg; BMI: 20.5 ± 2.3 kg/m²), all with provincial-level competitive experience, voluntarily participated in the study. Participants engaged in three training sessions per week (Ilham et al., 2024).

Following dynamic balance assessment, participants were stratified into high and low dynamic balance groups using a percentile-based classification. To ensure balanced group allocation, an A-B-B-A pairing method was employed, alternating assignments to maintain group equivalence. Randomisation was executed using IBM SPSS Version 25 to reduce selection bias. The Y Balance Test (YBT) served as the basis for dynamic balance classification, with groupings derived from the highest and lowest performance scores (Garima et al., 2024; Olszewski et al., 2024) which measures dynamic postural control, has been reported to be predictive of lower limb injuries in athletes. It requires subjects to control their body while maintaining a single-leg stance,

which necessitates sufficient strength of the hip muscles to maintain stability. The purpose of the study was to investigate the correlation between the performance of the YBT-LQ and the hip abductor or extensor muscle strength in athletes following anterior cruciate ligament reconstruction surgery (ACLR).

All participants were fully informed of the research procedures and provided written informed consent prior to participation. For those under 18 years of age, additional written consent was obtained from a parent or legal guardian, along with participant assent, by ethical and legal standards. The study was conducted in line with the Declaration of Helsinki and received ethical approval from the Ethics Committee of Universitas Negeri Padang (Approval No: 13.02/KEP-UNP/5/2024).

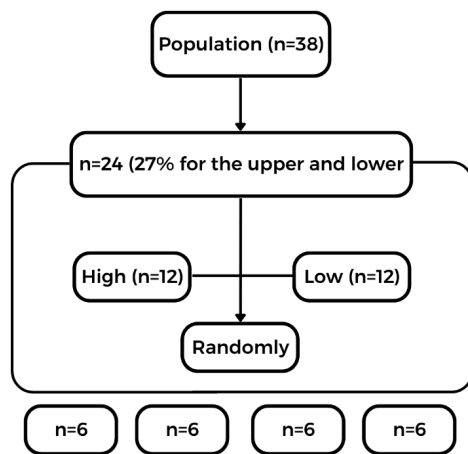


Fig. 1. The research's treatment group assignment process

Training Protocol

The program ran for six weeks, with training sessions conducted three times per week. Each session began with a 10-minute warm-up that included both static and dynamic stretching. The 30-minute agility training included ladder drills that focused on rapid footwork, coordination, direction changes, and explosive power through hurdle jumps. Participants performed three sets of two ladder drill variations—snake jumps and icky shuttle sequences—with 30 seconds of rest between sets. Each session concluded with a 5-minute cool-down that included recovery and active stretching.

Small-sided games (SSG) training utilised a 3v3 format on a 10×10 meter field, with a 2:1 work-to-rest ratio (2 minutes of activity, 1 minute of rest) repeated for 8 sets. Each session began with Team A playing against Team B, and Team C playing against Team D. A 2-minute work interval and a 1-minute rest interval followed each repetition. The cumulative activity duration per repetition is 3 minutes, yielding a total training period of 24 minutes for all 8 repetitions, encompassing both work and rest intervals. This style offers many roles for players, sustains game tension, and improves tactical abilities and physical fitness. The training protocol was designed by the first author, who is a certified fitness trainer.

Training intensity was progressively increased each week, in line with the principles of overload and individualization. During the first two weeks, the emphasis was placed on movement recognition and technical refinement at a moderate intensity level. In the third and fourth weeks, both the complexity and intensity of exercises were elevated, incorporating multi-directional movements and varied speed drills. The final two weeks (weeks five and six) focused on maximal effort, emphasising high-speed execution and rapid transitions. A tapering phase was introduced in week four to allow for recovery and optimal performance in the concluding stage of the intervention.

Measurements and Data Collection

Participants completed the Y-Balance Test – Lower Quarter (YBT-LQ) in the anterior, posterolateral, and postero-medial directions (Bodden et al., 2024; Garima et al., 2024; Olszewski et al., 2024)posterior medial (PM. Prior to testing, the trainer provided standardised verbal instructions and visual demonstrations. During the test, participants placed both hands on the iliac crest, and the foot most frequently used for kicking served as the support foot. The big toe of the support foot was positioned at the intersection of three measuring tapes fixed on the floor. While maintaining balance on the support foot, participants extended the opposite foot to reach as far as possible in the designated direction, touched the ground lightly with the big toe, and then returned to the starting position. To avoid the influence of footwear, all tests were performed barefoot. Following three familiarization trials, participants rested for two minutes before performing three test trials per direction. The order of reaching directions was randomised. Any trial in which balance was lost or the starting position was not properly regained was discarded and repeated. The longest reach distance in each direction was recorded for analysis. Reach distances were normalised to leg length to account for individual differences (Bodden et al., 2024)posterior medial (PM with leg length measured from the anterior superior iliac spine to the centre of the ipsilateral medial malleolus (Amani-Shalamzari et al., 2019; Souilah & Kessouri, 2024)anaerobic power and agility of young futsal players. It was also aim of this study to compare the variations on the internal load markers (heart rate and perceived exertion. A composite score was calculated using the formula: (sum of three directions / [leg length × 3]) × 100 (Ozmen & Aydogmus, 2016).

Agility performance was assessed using the Illinois Agility Test under standardised conditions. Participants began the test lying on their backs with their head aligned to the start line and both hands placed on their shoulders. Upon the command “Go,” the stopwatch was started. The participant quickly rose, sprinted 10 meters forward around a set of cones, ran 10 meters backward, and completed a slalom run through four cones. This was followed by another 10-meter sprint forward and backwards, finishing past the last cone, at which point the timing stopped. Each participant performed three trials with a two-minute rest between trials. The fastest recorded time was used for statistical analysis. All assessments were conducted on a futsal court, with cones positioned at standard intervals, and a trained coach supervised the tests to ensure accuracy and minimise variability.

Statistical Analysis

Descriptive statistics were employed to summarise participant characteristics and evaluate the effects of the training intervention. The Shapiro–Wilk test was used to assess the normality of data distribution, while Levene’s test evaluated the homogeneity of variances. A two-way analysis of variance (ANOVA) was conducted to examine the main effects and interaction effects of training modality and dynamic balance on agility performance. Where significant differences were detected, Tukey’s post-hoc test was applied to determine specific group differences ($p < 0.05$). Effect sizes were calculated using partial eta squared (η^2) to quantify the magnitude of observed effects. Additionally, 95% confidence intervals were reported to enhance the interpretability and reliability of the findings. All statistical analyses were performed using IBM SPSS Statistics Version 25, with the significance threshold set at $p < 0.05$.

Results

The results showed improvements in agility from pre- to post-test in all groups: A1B1 (18.56 ± 0.18 to 14.57 ± 0.47), A1B2 (18.62 ± 0.12 to 17.08 ± 0.46), A2B1 (18.45 ± 0.09 to 15.99 ± 0.51), and A2B2 (18.63 ± 0.10 to 16.58 ± 0.40). The highest improvement was recorded in group A1B1, with a 21.53% increase ($\Delta = 3.99$ seconds). The A2B1 group showed a 13.33% improvement ($\Delta = 2.46$), ranking second among the groups. Subsequently, the A2B2 group exhibited the third-highest proportion at 11.03% (2.06). The A1B2 group demonstrated an 8.26% improvement ($\Delta = 1.54$), the lowest among the four groups. Further details are presented in Table 2.

Table 2. The mean differences, standard deviations, and percentage improvements in pre-test and post-test agility scores for each treatment group

Agility Method	Agility DB level of each group (n = 5)	Pre Test	Post Test	Δ	%
		$\bar{x} \pm SD$	$\bar{x} \pm SD$		
SSG	High (A1B1)	$18,56 \pm 0,179$	$14,57 \pm 0,470$	3,99	21,53
	Low (A1B2)	$18,62 \pm 0,120$	$17,08 \pm 0,460$	1,54	8,26
LD	High (A2B1)	$18,45 \pm 0,091$	$15,99 \pm 0,510$	2,46	13,33
	Low (A2B2)	$18,63 \pm 0,102$	$16,58 \pm 0,400$	2,06	11,03

Note : Notes: DB = dynamic balance, SSG = small side games, LD = ladder drill, Δ = delta

The study’s findings indicated that the average agility scores for groups A1 and A2 were 15.71 ± 1.336 and 16.28 ± 0.464 , respectively. For groups B1 and B2, the means were 15.28 ± 0.876 and 16.83 ± 0.276 , respectively. The mean agility scores for groups A1B1 and A2B1 were 14.57 ± 0.47 and 15.99 ± 0.51 , respectively. Similarly, A1B2 and A2B2 recorded values of 17.08 ± 0.46 and 16.58 ± 0.40 , respectively. Table 2 confirms that the A1B1 group showed the most substantial improvement compared to the other treatment groups. The information is displayed in Table 3 and Figure 2. Table 4 shows that the data met assumptions of normality and homogeneity ($p > 0.05$). Figure 3 presents the Q–Q plot and the detrended Q–Q plot.

Table 3. The outcomes of the agility for each treatment group

Group	n	Min	Max	M \pm SD
A1	12	14,21	17,13	$15,71 \pm 1,336$
A2	12	15,28	16,83	$16,28 \pm 0,464$
B1	12	14,21	16,83	$15,28 \pm 0,876$
B2	12	16,52	17,13	$16,83 \pm 0,276$
A1B1	6	14,21	15,43	$14,57 \pm 0,470$
A2B1	6	15,24	16,83	$15,99 \pm 0,510$
A1B2	6	17,01	17,13	$17,08 \pm 0,460$
A2B2	6	16,52	16,78	$16,58 \pm 0,400$

Note: The dependent variable was agility, measured in seconds. “A1” refers to Small Side Games training, “A2” indicates ladder drill training, “B1” indicates high dynamic balance, “B2” signifies low dynamic balance, “A1B1” describes Small Side Games training with high dynamic balance, “A2B1” relates to ladder drill training with high dynamic balance, “A1B2” describes Small Side Games training with low dynamic balance, and “A2B2” relates to ladder drill with low dynamic balance.

Table 4. Testing for normality and homogeneity

Normality test	Homogeneity test
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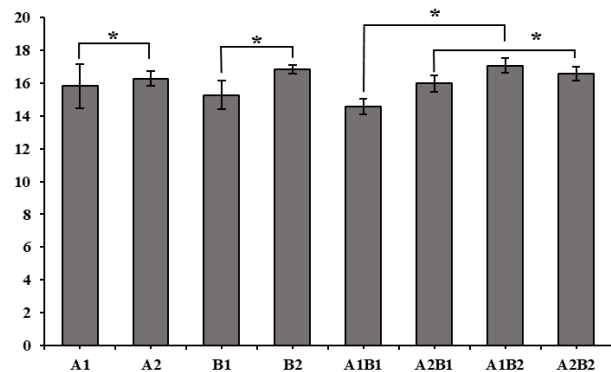


Fig. 2. The mean agility of each treatment group (* $p < 0.05$) in comparison to each group. The statistics are shown with mean and standard deviation values for agility

Shapiro-Wilk			Levene’s		
Statistic	df	p	df1	df2	P
0.142	24	0.107	3	20	0.387

Note: The data are normally distributed and homogeneous ($P > 0.05$).

Table 5 presents the results of the two-way ANOVA. The table shows significant differences in agility scores between groups A1 and A2 ($p < 0.05$) and between B1 and B2 ($p < 0.05$). Figure 4 shows a significant interaction between groups A and B ($P < 0.05$). A Tukey post hoc test was conducted to identify which specific group differences in agility were statistically significant.

Table 6 demonstrates that Tukey’s post hoc analysis indicated that group A1 outperformed group A2 ($P < 0.05$) in enhancing agility. This was evidenced by the lower mean score of group A1 (15.71) compared to A2 (16.28). Likewise,

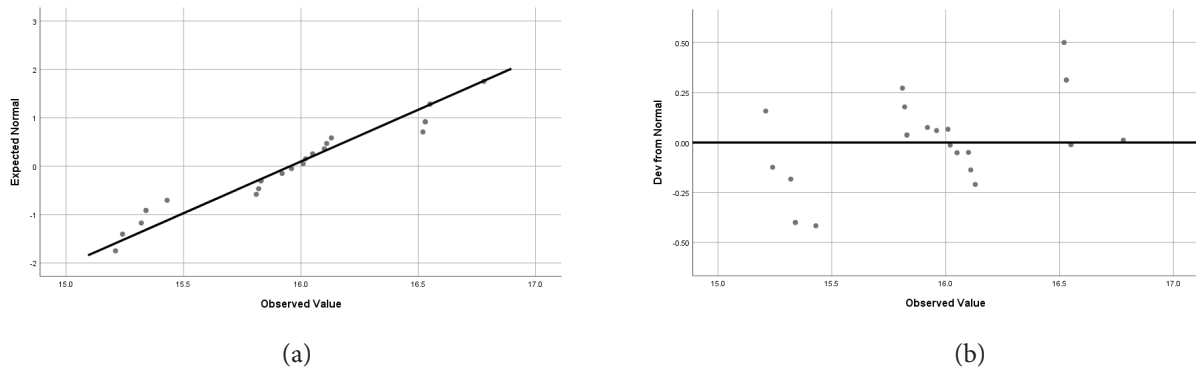


Fig. 3. (a) Normality Q-Q Plot and Detrended Normality Q-Q Plot Graphs

group B1 outperformed group B2 ($p < 0.05$), with mean agility scores of 15.28 and 16.83, respectively. Group A1B1 had significantly better agility than A2B1 ($p < 0.05$), with average times of 14.57 and 15.99 seconds, respectively. Additionally, A2B2 outperformed A1B2 ($p < 0.05$), with mean scores of 16.58 and 17.08, respectively.

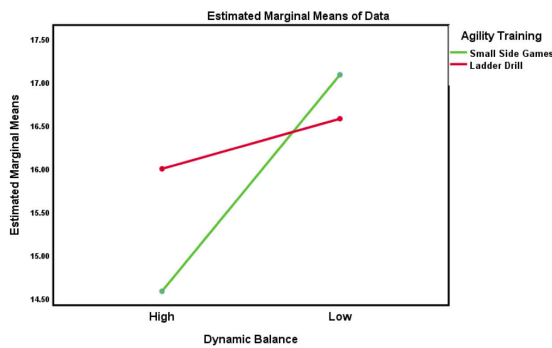


Fig. 4. The relationship between agility training and dynamic balance (DB)

Table 5. Two-way factorial ANOVA

Origin	Type III Sum of Squares	df	Mean Square	F	P
Agility Training (A)	1.238	1	1.238	9.985	.005
Dynami Balance (B)	14.307	1	14.307	115.429	.000
Agility Training (A) * Dynamic Balance (B)	5.578	1	5.578	45.002	.000

Note: Agility served as the dependent variable in this study. A statistically significant difference was found between the SSG (A1) and LD (A2) training groups ($p < 0.05$), indicating that the type of agility training had a measurable impact on agility performance. Additionally, a significant difference was observed between participants with high (B1) and low (B2) dynamic balance levels ($p < 0.05$). Notably, a significant interaction effect between training modality and dynamic balance level ($A \times B$) was identified ($p < 0.05$), demonstrating that the athletes' dynamic balance capacity influenced the effectiveness of agility training.

Discussion

The purpose of this study was to examine the impact of small-sided games and ladder drills on agility, with dynamic

Table 6. Tukey's test

Compare Groups	P	Conclusion
A1 and A2	0.006	Significant
B1 and B2	0.000	Significant
A1B1 and A2B1	0.000	Significant
A1B2 and A2B2	0.001	Significant

Note: The variable that depends on others is agility. The difference is statistically significant ($P < 0.05$).

balance as a moderating factor. The findings revealed that both training methods significantly improved agility, with small-sided games yielding greater improvements, particularly among participants with higher dynamic balance. Additionally, it was found that dynamic balance influenced the level of agility improvement, with players exhibiting higher dynamic balance showing more significant performance improvements.

The higher effectiveness of small-sided games training can be attributed to the specific nature of the training. In small-sided games training, the rules of the game are modified, such as the size of the field, number of players, duration, and verbal encouragement from technical staff (Kunz et al., 2019; Yenes et al., 2025). During training, small-sided games can increase the frequency of movement, acceleration/deceleration density, and optimal changes in direction (Young & Rogers, 2014). Small-sided games require players to make rapid decisions, adapt to dynamic situations, and engage in realistic gameplay, which enhances oxygen uptake, agility, and repeated sprint ability (Chaouachi et al., 2014; Ouertatani et al., 2022). Meanwhile, ladder drill emphasizes quick footwork, proper body control, rhythm, balance, and regular changes of direction (Padrón-Cabo et al., 2021; Prakash et al., 2021). While ladder drills rely on planned and repetitive movements (Bassa et al., 2024), small-sided games demand reactive, unpredictable actions that mirror real match situations (Karahana, 2020).

Small-sided games more effectively replicate match-specific conditions in futsal, thereby enhancing player engagement, motivation, decision-making, and creativity (Amani-Shalamzari et al., 2019; Sekulic et al., 2019). Training that resembles actual game situations can be an effective multi-component training strategy (Mota et al., 2022). Investigating the offensive sequences that lead to goals in elite futsal matches reveals that game situation training is

crucial in the development of physical fitness and technique (Sari et al., 2025; Sarmiento et al., 2016). The results of the current meta-analysis reveal moderate beneficial effects of small games on 10- and 20-meter sprint performance and jump height, as well as significant beneficial effects on agility (Bujalance-Moreno et al., 2019; Clemente, Afonso, et al., 2021). Thus, small-sided games contribute to moderate to significant improvements in physical fitness variables relevant to team sports.

Another important finding was the moderating effect of dynamic balance on agility development. Dynamic balance refers to the ability to maintain balance while moving, such as when changing direction or making sudden movements (Bashir et al., 2019; Neptune & Vistamehr, 2019). In other words, body segments seem to maintain their direction of movement due to inertia, while balance capacity ensures positional stability and subsequent changes in direction (J. Wang et al., 2025). Well-developed dynamic balance enables runners to maintain proper running form and technique, which is crucial for maximizing their speed and power (Dominguez-Navarro et al., 2023; Jouira et al., 2024). Meanwhile, athletes with poor dynamic balance development experience a loss of control, which can lead to inefficient movements, slower times, and increased risk of injury (Wilczyński et al., 2021).

Balance involves performing movements in harmony with the central nervous system and musculoskeletal system (Gouveia et al., 2019; Lesinski et al., 2015). Having good dynamic balance skills indicates that athletes have fewer postural oscillations and greater stabilization (Domínguez-Navarro et al., 2022; Zech et al., 2018). Previous studies have demonstrated a relationship between dynamic balance and reactive agility, with improvements in dynamic balance skills leading to enhanced reactive agility performance (Kocahan et al., 2022; Stirling et al., 2018). However, interestingly, individuals with low dynamic balance benefit from small games and ladder drills. This suggests that structured agility programs are beneficial for all types of balance. Maximizing an athlete's agility potential may require a customized training regimen that considers balance and other physical characteristics.

Coaches, instructors, and sports scientists involved in futsal and related sports will find the findings of this study beneficial. Agility training programs must include workouts that closely replicate the specialized movement patterns of the sport, such as small-sided games, to attain significant enhancements in player performance. Athlete evaluations should encompass supplementary examinations, including balance evaluations, to tailor training loads, progressive programs, and other therapies to individual requirements. This study highlights the potential for further research to determine the optimal combination of training regimens tailored to customized athletes with varying physical attributes. Prolonging intervention durations and integrating diverse training intensities can yield significant insights into the long-term development and preservation of agility during an athlete's career.

Conclusions

This study illustrates that both SSG and LD are efficacious in improving the agility of futsal players. Nonetheless, SSG

demonstrated superior efficacy compared to LD, irrespective of the athletes' dynamic balance proficiency. Athletes with superior dynamic balance demonstrated considerably enhanced agility, highlighting the essential importance of neuromuscular coordination and postural control in agility training adaptations.

These findings underscore the need to develop training programmes tailored to individual neuromuscular profiles. Customising agility interventions according to an athlete's dynamic balance ability may promote more equal and effective performance improvements among various sports groups. Subsequent research ought to investigate supplementary physical and physiological variables, including muscular strength, power output, flexibility, and cardiovascular endurance, and their interactions with agility-centric training. Furthermore, longitudinal studies are essential to evaluate the enduring durability of training-induced enhancements and to determine the most effective combinations of training modalities for various age demographics, competitive tiers, and physical characteristics. These investigations will enhance the formulation of tailored and evidence-based training methods designed to optimise performance in futsal and associated sports.

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Conflict of interest

All authors assert the absence of any conflict of interest.

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Вплив шеститижневої інтервенції з використанням ігор неповними складами (ІНС), тренувань з координаційною драбиною та динамічної рівноваги на спритність юних футзалістів

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 11 с., 6 табл., 4 рис., 73 джерел.

Мета дослідження. Мета цього дослідження полягала в порівнянні впливу ігор неповними складами (ІНС) та тренувань з координаційною драбиною (ТКД) на спритність футзалістів з різним рівнем динамічної рівноваги (ДР), яка розглядалася як модеруюча змінна.

Матеріали та методи. Двадцять чотири футзалісти чоловічої статі (середній вік: 17.1 ± 0.8 років) розподілено за методом рандомізації на групи ІНС або ТКД із подальшою класифікацією за високим або низьким рівнем ДР, що дозволило сформувати чотири експериментальні підгрупи. Протягом 6-тижневої інтервенції (3 сесії на тиждень) учасники проходили специфічні тренування, спрямовані на розвиток спритності, яка оцінювалася за допомогою Іллінойського тесту на спритність. Для вимірювання динамічної рівноваги використовувався Y баланс-тест. З метою оцінки основних і взаємодійних ефектів застосовано двофакторний дисперсійний аналіз з використанням post hoc тесту Тьюкі ($p < 0.05$).

Результати. Обидві тренувальні інтервенції призвели до значного поліпшення показників спритності ($p < 0.05$). Гравці з високим рівнем ДР продемонстрували найсуттєвіші результати після проведення ІНС (покращення на 21.5%), тоді як гравці з низьким рівнем ДР досягли більших успіхів після виконання ТКД (покращення на 11.0%). Між типом тренування та рівнем ДР спостерігалася значна взаємодія, що свідчить про залежність адаптаційних процесів спритності від рівня майстерності спортсменів у підтримці рівноваги.

Висновки. Ефективність тренування спритності у футзалістів модерується індивідуальною здатністю до динамічної рівноваги. ІНС є особливо ефективним методом для гравців з високим рівнем ДР через репрезентативні для гри вимоги до рухів, тоді як ТКД забезпечує структуроване поліпшення для гравців з низьким рівнем ДР. Зазначені результати підтверджують доцільність впровадження індивідуальних стратегій тренування на основі нервово-м'язових профілів задля оптимізації розвитку спритності у футзалі.

Ключові слова: ігри неповними складами, тренування з координаційною драбиною, динамічна рівновага, спритність, футзал.

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