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Guided recreational training as a catalyst for improving agility, flexibility, and motor coordination in 16-year-old youth football players

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Abstract

Background: Many adolescents fail to meet recommended physical activity levels, and participation in organized sports often declines during adolescence due to burnout and reduced enjoyment. Structured recreational training may help maintain engagement while enhancing motor development in youth football players.
Aim: This study aims to implement a guided recreational training program specifically designed to enhance agility, flexibility, and coordination in 16-year-old youth football players in Iraq, addressing the research gap related to the limited availability of multi-component programs in resource-constrained settings
Methods: Forty-eight male football players participated in the study. Eight participants were assigned to a pilot study to refine the testing procedures, while the remaining 40 players were randomly allocated to an experimental group (n = 20) and a control group (n = 20). Over 12 weeks, the experimental group completed 24 recreation-based sessions (2 sessions/week, 1 hour each), whereas the control group followed regular training. Agility, flexibility, and coordination were assessed before and after the intervention.
Result: The experimental group showed significant improvements over controls in all variables: agility ($t = -39.920$, $p < 0.001$), flexibility ($t = 24.724$, $p < 0.001$), and coordination ($t = -26.726$, $p < 0.001$). Regression analysis indicated no significant effect of pre-test scores on agility and coordination, while flexibility had a modest predictive effect ($B = 0.217$, $p = 0.040$).
Conclusion: Guided recreation-based training effectively improved agility, flexibility, and coordination in adolescent football players. The findings suggest that integrating structured recreational components into football training programs may provide a more varied and enjoyable learning environment compared with conventional methods, while supporting motor skill development.

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INTRODUCTION

Globally, approximately 80% of adolescents aged 11–17 years fail to meet the recommended levels of physical activity (Araujo et al., 2024). Concurrently, evidence from the American Academy of Pediatrics indicates that a substantial proportion of youth withdraw from organized sport during early adolescence, often due to burnout, overtraining, and reduced enjoyment (Brenner & Watson, 2024). Considering these concerns, there is an increasing need for innovative and engaging training approaches—such as structured recreational sport—that can sustain participation while simultaneously supporting motor development.

Building on this concern, recent empirical research increasingly emphasizes the role of structured recreational sport in promoting fundamental motor development in youth athletes.

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Participation in such programs has been associated with improvements in core motor abilities, including agility, flexibility, and coordination, which are central to youth sport performance (Dapp et al., 2021; Moon et al., 2024; Jafar et al., 2023; Abusleme-Allimant et al., 2023; Liu et al., 2025). These interventions provide consistent and varied movement experiences that facilitate motor learning and skill refinement during adolescence, a critical developmental period for physical competence (Bates et al., 2021; Carbone et al., 2021).

From a developmental perspective, motor development in adolescence is strongly influenced by structured physical activity environments that promote repeated practice, progressive overload, and movement variability (Dorsch et al., 2022; Coutinho et al., 2022). In this context, multi-dimensional training approaches have demonstrated superior outcomes in overall motor proficiency compared with isolated skill-based models (Dapp et al., 2021). Moreover, motor learning research suggests that performance adaptation results from complex interactions between individual characteristics and practice environments, leading to variability in training responses (Anderson et al., 2021). Accordingly, integrative and well-designed recreational programs may better align with these adaptive principles than traditional, compartmentalized approaches.

In addition to these general principles, within youth football contexts, agility, flexibility, and coordination represent essential components of performance. Agility supports rapid directional changes in dynamic game situations (Young et al., 2022), flexibility contributes to efficient movement execution and injury prevention (Vincent et al., 2022), and coordination enables the integration of complex motor actions with precision and balance (Bing et al., 2023). Collectively, these abilities underpin both technical execution and tactical responsiveness (Moon et al., 2024; Young et al., 2022). Despite these established benefits, many youth programs continue to emphasize isolated performance components rather than embedding motor abilities within a unified recreational framework. Furthermore, a considerable proportion of existing interventions are developed in well-resourced contexts, limiting their applicability in resource-constrained environments (Moon et al., 2024).

In youth football specifically, applied training practices frequently focus on discrete elements, such as agility drills or technical repetition, without incorporating a comprehensive, play-based structure that integrates multiple fundamental motor abilities (Coutinho et al., 2022; Young et al., 2022). Nevertheless, evidence suggests that play-based and structured recreational formats enhance motivation and engagement while supporting motor development (Wik, 2022; Șandra et al., 2022; Bogalho et al., 2022; Persson, 2023). Taken together, these limitations indicate a clear research gap in the development of a contextually adaptable, structured recreational training program that simultaneously integrates agility, flexibility, and coordination within a cohesive framework suitable for resource-limited settings, while accounting for the adaptive nature of motor learning in youth football players (Anderson et al., 2021). Addressing this gap may contribute to both performance enhancement and sustained participation in sport.

In response to this gap, the proposed program is distinct from existing interventions in three ways: (a) it simultaneously targets agility, flexibility, and coordination within a single structured framework; (b) it is designed to be feasible in resource-limited settings such as Iraq; and (c) it incorporates a progressive, play-based structure to sustain engagement and motivation.

Accordingly, the present study aims to implement a guided recreational training program designed to improve agility, flexibility, and coordination in 16-year-old youth football players in Iraq. It is hypothesized that: (H1) the guided recreational training program will significantly enhance agility, flexibility, and motor coordination; and (H2) it will produce greater improvements compared with traditional training methods in these motor abilities.

METHOD

Research Design.

An experimental design with two equivalent groups and pre- and post-tests was employed to examine the effects of a guided recreational training program on agility, flexibility, and motor coordination. The study population initially consisted of forty-eight 16-year-old male youth football players registered at the National Center for Talented Sports in Babil Governorate, Iraq, during the 2024–2025 season. Before randomization, eight participants were assigned to a separate pilot group to conduct preliminary testing, assess the reliability of the measurement tools, and refine the training and assessment procedures. These participants were excluded from the main experimental procedures to avoid potential testing and learning effects. The remaining forty participants who met the study inclusion criteria were randomly allocated into an experimental group (n = 20) and a control group (n = 20) using a lottery method conducted by an independent researcher who was not involved in data collection or training sessions. Allocation concealment was maintained using sealed, opaque envelopes to minimize selection bias. A CONSORT-style flow diagram was prepared to illustrate participant recruitment, allocation, follow-up, and analysis procedures, as illustrated in Figure 1.

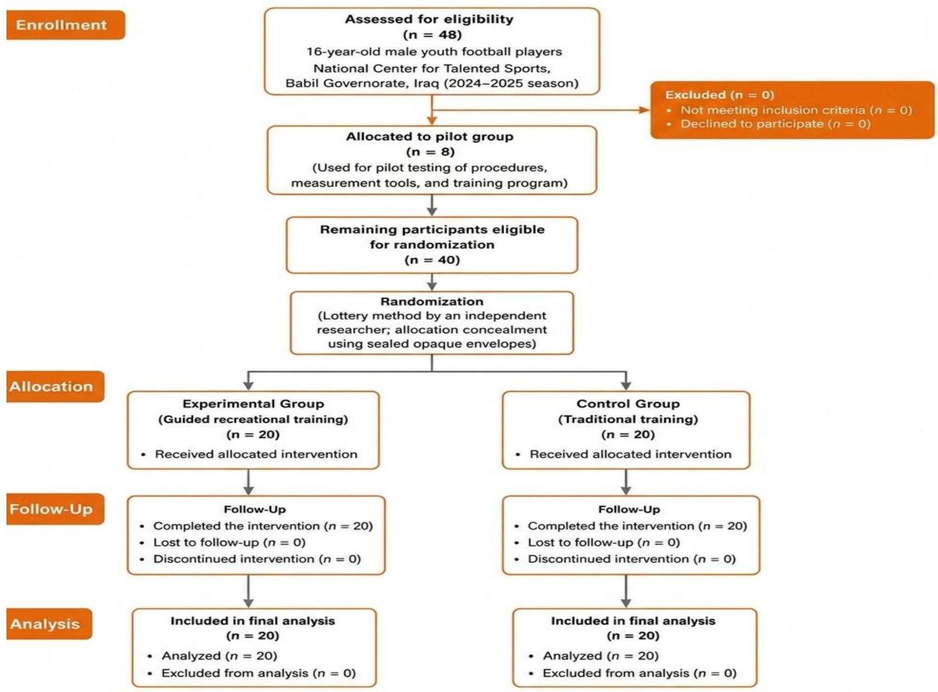

Figure 1: Consort Flow Diagram of Participant Enrollment, Randomization, Follow-up, and Analysis

Participants

The final sample consisted of forty 16-year-old male youth football players (mean age = 16.1 ± 0.2 years; age range = 16.0–16.5 years), all registered at the National Center for Talented Sports in Babil Governorate, Iraq. Participants had at least 1 year of continuous football training experience, with a mean of 3.1 ± 0.7 years. Inclusion criteria required participants to be 16 years old, officially registered at the center, in good health with no injuries affecting motor performance, and to have at least 1 year of consistent training experience. Written informed consent was obtained from parents or legal guardians.

Exclusion criteria included players outside the target age range, unregistered athletes, individuals with injuries or medical conditions that affect performance, those with insufficient training experience, or those lacking parental consent. All eligible participants completed the 12-week intervention without dropouts, and only the 40 players assigned to the experimental and control groups were included in the final statistical analysis. The sample size was determined based on the accessible population at the National Center for Talented Sports and the strict inclusion criteria used in the study. Given the experimental design and the participants' homogeneity, the final sample of 40 players was considered adequate and consistent with sample sizes commonly used in comparable youth football intervention studies.

Ethical Considerations, written informed consent was obtained from the parents or legal guardians of all 16-year-old participants. They were fully briefed on the study's objectives, procedures, duration, and potential risks. All recreational activities were age-appropriate, safe, and supervised by qualified instructors. Participants were assured of the confidentiality of their data and informed of their right to withdraw from the program at any time without penalty. The study was conducted in accordance with the principles of the Declaration of Helsinki and received ethical approval from the Research Ethics Committee of the University of Hilla, Iraq (Administrative Order No. 1918, October 1, 2024).

Instrumentation

Agility: Barrow Zigzag Run Test. Agility was measured using the Barrow Zigzag Run Test, which assesses a player's ability to change direction quickly and efficiently while maintaining balance and body control. The test requires a rectangular running area measuring 4.75 m × 3 m, five cones, and a stopwatch, with a distance of 2 m between each cone. The player begins the test by standing behind the starting line. Upon the start signal, the participant runs at maximum speed in a zigzag pattern between the cones following the designated course. The course is completed three consecutive times without stopping, while maintaining precise movement and avoiding stepping outside the testing area. A timekeeper provides the start signal and records the total performance time, while a recorder documents the results for each participant. The final score is calculated as the total time from the start signal to the player's crossing of the finish line after completing the third run, with lower times indicating better agility (Al-Hakim, 2014).

Flexibility: Dynamic Spinal Flexibility Test. Flexibility was assessed using the Dynamic Spinal Flexibility Test, which measures dynamic flexibility through movements involving spinal flexion, extension, and rotation. The test requires a stopwatch and a wall. Two marks (×) are prepared before testing: one placed on the floor between the participant's feet and another positioned on the wall behind the participant's back at the center level. The participant begins the test upon the start signal by bending the trunk forward to touch the floor mark with the fingertips, then extending the trunk upward while rotating to the left to touch the wall mark behind the back. This is followed by another forward bend to touch the floor mark, then an extension with a right rotation to touch the wall mark. This sequence repeats continuously for 30 seconds, ensuring that both left and right wall touches are completed in the required pattern. Throughout the test, the feet must remain fixed in position, and the knees must remain extended without bending. The score is determined by counting the total number of successful touches on both the floor and wall marks within 30 seconds (Hassanein, 2013).

Coordination: Numbered Circles Test. Coordination was assessed using the Numbered Circles Test, which measures hand–foot coordination by evaluating the participant's ability to synchronize lower-limb movements with visual guidance. The test requires a stopwatch and eight circles drawn on the ground, each with a diameter of 60 cm and numbered sequentially from 1 to 8. The participant begins the test standing inside circle number 1. At the start signal, the participant jumps with both feet together from circle 1 to circle 2, then continues sequentially through circles 3-8 as quickly as possible. Maximum speed is maintained throughout the task while ensuring accuracy in following the correct sequence. Jumps must be performed with both feet together, and the participant is required to strictly follow the numbered order of the circles. The total time taken to complete the sequence from the first to the last circle is recorded, with shorter times indicating better coordination performance (Al-Hakim, 2014).

Testing Standardization and Procedures: All tests were conducted under standardized conditions with identical layouts and calibrated equipment (digital stopwatches with ±0.01 s accuracy, marked surfaces, and uniform cones). Two trained assessors administered all tests following a structured training session to ensure consistent scoring. One familiarization trial was given before official testing to minimize learning effects. A pilot study (n = 8) confirmed that all procedures were appropriate for 16-year-old male football players and ensured clarity, feasibility, and engagement.

Validity and Reliability.

A panel of 14 experts in football testing, motor learning, and training methodology reviewed the research instruments. To determine the extent to which the instruments effectively measured the intended motor abilities, the Content Validity Ratio (CVR) was calculated using Lawshe's formula (Jebur et al., 2024; Anderson et al., 2021), based on a dichotomous response scale (suitable test / not suitable test). The CVR values were 1.000 for agility, 0.714 for flexibility, and 0.857 for coordination, all exceeding the minimum threshold of 0.51. These results confirm that the instruments accurately represent the motor abilities required for the target population.

Reliability was assessed in a pilot study involving eight male football players from the National Center for Talented Sports in Babil Governorate. Each participant completed the tests twice, with a two-week interval between sessions. Test–retest correlation coefficients ranged from 0.80 to 0.85 across all measures, indicating high stability and consistency ($p < 0.05$). All tests and procedures were reviewed and adapted for suitability to 16-year-old Iraqi football players. Pilot testing confirmed clarity of instructions, motivational engagement, and suitability for measuring agility, flexibility, and coordination.

Procedures

The study followed a pretest–posttest control group design consisting of three phases: pretest, intervention, and posttest. Both the experimental and control groups underwent identical assessment procedures throughout the study. During the pretest phase, baseline measurements of agility, flexibility, and coordination were collected using standardized testing protocols. To minimize potential learning effects, participants completed one familiarization trial for each assessment before formal testing. The intervention phase consisted of a 12-week Guided Sports Recreation Program conducted from November 11, 2024, to January 29, 2025. The program comprised 24 sessions delivered twice weekly (Mondays and Wednesdays), with each session lasting 60 minutes. The intervention was designed to improve agility, flexibility, and coordination through structured motor skill exercises and recreational games. All sessions were conducted by a certified football coach with a Bachelor's degree in Physical Education and 5 years of youth coaching experience. Before implementation, the coach received training on the intervention protocol to ensure consistency across sessions. Attendance, activity completion, and participant engagement were recorded via daily session checklists, while a senior supervisor observed one session per week to verify adherence to the study protocol.

Each session followed a standardized structure consisting of a 10-minute warm-up phase, a 20-minute main exercise phase, a 20-minute recreational games phase, and a 10-minute cool-down phase. The warm-up included dynamic exercises and playful movement activities designed to prepare the muscles and joints for physical activity. The main exercise phase focused on targeted motor skill drills to develop agility, flexibility, and coordination, with progressive increases in task difficulty through modifications in movement speed, balance requirements, range of motion, and movement precision. The recreational games phase integrated the targeted motor skills into enjoyable activities that promoted coordination, movement control, and active participation. The cool-down phase included stretching exercises, breathing activities, and reflection on movement quality.

The program emphasized natural movement patterns, enjoyment, and progressive motor skill development. Exercise intensity and task complexity were gradually increased throughout the intervention to promote improvements in agility, flexibility, and coordination, while activities were individually adapted according to participants' skill levels. Detailed session plans were prepared to facilitate program standardization and replication in future studies. Training intensity was maintained at a low-to-moderate level consistent with the recreational nature of the intervention. Warm-up and cool-down activities were performed at low intensity, whereas the main exercises and recreational games were conducted at light-to-moderate intensity levels. Intensity was regulated through exercise selection, movement pace, and rest intervals. In addition, participants' perceived exertion was periodically monitored using the Rating of Perceived Exertion (RPE) scale to ensure that the intended training intensity was maintained throughout the intervention. The coach continuously monitored participants and adjusted activity demands as needed to ensure an appropriate workload, safe execution, and sustained engagement. A summarized overview of the guided recreational training program, including session structure, training progression, and representative activities, is presented in Table 1.

Table 1: Guided Recreational Training Program Structure

Weeks	Focus Area	Main Activities (Examples)	Training Load & Progression	Objectives	Cognitive Integration
1–2	Agility	Tag games, zigzag running, direction-change drills, and passing races	3–4 sets × 20–30 s; 30–45 s rest; progression through faster execution and ball integration	Improve agility, reaction speed, and directional changes	Respond to verbal/visual cues and adapt movement rapidly
3–4	Flexibility	Dynamic stretching, balance drills, partner	3 sets × 10–12 repetitions; progression	Improve flexibility,	Coordinate with partners and respond to

Weeks	Focus Area	Main Activities (Examples)	Training Load & Progression	Objectives	Cognitive Integration
		rotations, and rope exercises	through increased range of motion and reduced support	balance, and trunk mobility	movement instructions
5–6	Coordination	Opposite-side passing, visual tracking drills, and mirror activities	4 sets × 30 s; progression through dual-task demands and increased movement speed	Enhance coordination and reaction time	Track multiple stimuli and make rapid movement decisions
7–8	Agility + Flexibility	Zigzag running with stretching, rotational balance drills, and obstacle games	3–4 circuits; progression through added movement complexity and shorter recovery periods	Integrate agility and flexibility skills	Adjust movement patterns according to dynamic game situations
9–10	Coordination + Flexibility	Sequential passing, eyes-closed movement drills and directional tunnel tasks	3 sets × 8–10 repetitions; progression through reduced reaction time and increased task variability	Improve sensory coordination, balance, and flexibility	Respond to auditory and visual commands while adapting to changing paths
11–12	Integrated Motor Skills	Multi-station drills, obstacle strategy games, and team challenges	4 integrated circuits; progression through combined motor and cognitive demands	Consolidate motor abilities and assess performance improvement	Apply teamwork, decision-making, and problem-solving under dynamic conditions

Following completion of the intervention, posttest assessments were conducted for both groups using the same instruments, procedures, and testing conditions as during the pretest phase. These assessments were used to determine changes in agility, flexibility, and coordination resulting from participation in the program.

Statistical Analysis

Data were analyzed using SPSS version 28 (IBM Corp., Armonk, NY, USA) at $\alpha = 0.05$. Normality was assessed using the Shapiro–Wilk test, and homogeneity of variance using Levene's test; all assumptions were met ($p > 0.05$). Independent samples t-tests were used to compare pre- and post-test differences between groups. Additionally, a multiple linear regression analysis was performed to control for baseline (pretest) values and to provide a more precise estimate of the intervention effect on posttest outcomes, thereby reducing the potential influence of initial individual differences among participants.

RESULTS AND DISCUSSION

Results

Pre-Test Results

Before the intervention, baseline assessments were conducted to verify the equivalence between the experimental and control groups. Table 2 presents the pre-test comparisons of agility, flexibility, and coordination.

Table 2: Pre-Test Comparison Between Experimental and Control Groups

Variable	Unit	Control Group Pre -tests (Mean ± SD)	Experimental Group Pre -tests (Mean ± SD)	t	p-value	95% CI of Difference
Agility	s	15.758 ± 0.115	15.731 ± 0.118	-0.407-	0.686	-0. 895 to 0.059
Flexibility	°	17.350 ± 0.933	17.521 ± 1.147	0.454	0.653	-8. 194 to 5. 194
Coordination	s	20.959 ± 0.161	20.911 ± 0.185	-0.639-	0.527	-1. 459 to 0. 759

As shown in Table 2, there were no statistically significant differences between the experimental and control groups in any of the measured variables at baseline (Jebur et al., 2025). Additionally, the 95% confidence intervals for the mean differences included zero, indicating comparable baseline levels between groups. This supports the assumption that any subsequent changes in agility, flexibility, and coordination can be attributed to the intervention rather than pre-existing differences (Jebur et al., 2025). Figure 2 illustrates these pre-test comparisons.

Post-Test Results

Following the 12-week Guided Sports Recreation Program, post-test assessments were conducted to evaluate its effectiveness. Table 3 presents the post-intervention comparisons.

Table 3: Post-Test Comparison Between Experimental and Control Groups

Variable	Unit	Control Group Post -Test (Mean ± SD)	Experimental Group Post -Test (Mean ± SD)	t	p-value	95% CI of Difference
Agility	s	15.510 ± 0.078	14.025 ± 0.144	-39.920-	<0.001	-1.566 to -1.415
Flexibility	°	18.500 ± 0.512	23.950 ± 0.825	24.724	<0.001	5.027 to5.925
Coordination	s	20.550 ± 0.403	17.660 ± 0.272	-26.726	<0.001	-3.134 to -2.692

The post-test results indicate that the experimental group significantly outperformed the control group in all measured variables. Agility ($t = -39.920$, $p < 0.001$), flexibility ($t = 24.724$, $p < 0.001$), and coordination ($t = -26.726$, $p < 0.001$) showed statistically significant improvements. The 95% confidence intervals for all differences excluded zero, confirming the reliability of these effects. These findings demonstrate a substantial positive impact of the 12-week guided sports recreation program on physical performance and motor skill development, as illustrated in Figure 3.

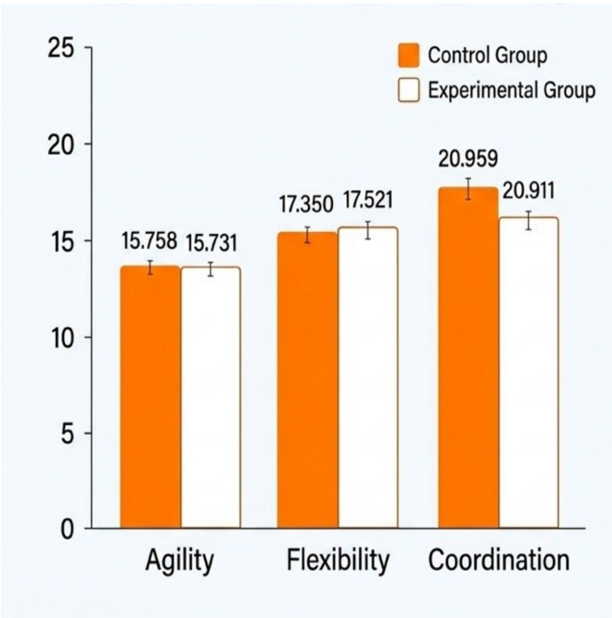

Figure 2: Bar chart of pre-test comparisons between experimental and control groups.

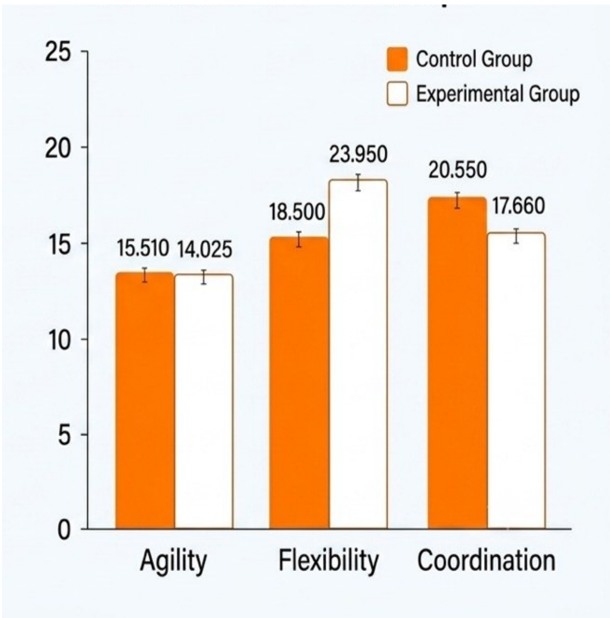

Figure 3: Bar chart of post-test comparisons between experimental and control groups.

Multiple Linear Regression

To control for initial performance levels, multiple linear regression analyses were conducted to examine the effect of the 12-week Guided Sports Recreation Program on post-test outcomes in 16-year-old football players. Tables 4 and 5 summarize the model fit and regression coefficients.

Table 4: Summary of Model Fit and ANOVA for Regression

Variable	R Square	Adjusted R-Square	Std. Error of the Estimate	Sum of Squares	df	Mean Square	F	p-value
Agility	0.977	0.976	0.117	22.054	2	11.027	794.632	<0.001
Flexibility	0.949	0.946	0.657	298.974	2	149.487	345.678	<0.001
Coordination	0.950	0.948	0.343	83.648	2	41.824	354.049	<0.001

Table 5: Regression Coefficients for Post-Test Scores

Variable	Model	B	Beta	t	p-value	95.0% Confidence Interval for B	VIF
Agility	(Constant)	11.549	-	4.477	<0.001	6.322 to 16.776	1.004
	Pre_ AG	0.063	0.010	0.384	0.703	-0.269- to 0.395	
Flexibility	(Constant)	25.577	-	13.973	<0.001	21.868 to 29.286	1.005
	Pre_ FL	0.217	0.079	2.123	0.040	0.010 to 0.423	
Coordination	(Constant)	7.799	-	1.160	0.253	--5.818- to 21.417	1.011
	Pre_ CO	0.334	0.038	1.038	0.306	-0.318- to 0.986	

Model Fit: The R^2 values indicate that the regression models explained a very high proportion of the variance in post-test outcomes: 97.7% for agility, 94.9% for flexibility, and 95.0% for coordination. Adjusted R^2 values remained comparably high, confirming model reliability. Low standard errors of estimate suggest precise predictions, particularly for agility. Large F-values ($p < 0.001$) indicate that the models were statistically significant and that the intervention significantly predicted improvements in the dependent variables.

Regression Coefficients: Controlling for pre-test scores, the analysis confirmed that improvements in agility, flexibility, and coordination were primarily attributable to the recreational program rather than baseline differences. Pre-test scores had no significant effect on post-test agility ($B = 0.063$, $p = 0.703$) or coordination ($B = 0.334$, $p = 0.306$), while pre-test flexibility exhibited a small but statistically significant effect ($B = 0.217$, $p = 0.040$). All VIF values were close to 1, indicating no multicollinearity among predictors.

The combination of statistically significant regression results, high R^2 values, and large effect sizes confirms that the 12-week guided sports recreation program effectively enhanced motor skills in 16-year-old youth football players. Improvements in agility, flexibility, and coordination were primarily driven by the intervention itself, demonstrating both statistical and practical significance. These findings strengthen the study's internal validity and highlight the program's practical value in developing essential athletic skills among adolescent football players.

Discussion

Implications

The present study examined the effectiveness of a guided recreational training program in improving agility, flexibility, and motor coordination among 16-year-old youth football players. The findings demonstrated significant improvements in all three motor abilities in the experimental group compared with the control group. Regression analysis suggests that the observed improvements were largely attributable to the intervention, although other uncontrolled factors cannot be entirely ruled out. Although the regression models yielded high R^2 values, these findings should be interpreted with caution, given the relatively homogeneous sample and the possibility that strong intervention effects may have inflated the estimated explained variance.

From a theoretical perspective, the observed improvements may be explained by neuromuscular adaptations resulting from repeated exposure to varied and progressively challenging motor tasks. Such adaptations are consistent with motor learning theory, which emphasizes the importance of practice variability and task repetition for improving motor performance (Schmidt et al., 2018; Williams et al., 2004; Dapp et al., 2021). The structured and enjoyable nature of the recreational activities may have created a more engaging training environment, which could plausibly support higher levels of participation and effort, although motivation was not directly measured in the present study (Wulf & Lewthwaite, 2016; Cushion et al., 2012).

Improvements observed in agility, flexibility, and coordination are consistent with neuromuscular adaptation processes that enhance movement efficiency. Regular engagement in varied movement tasks likely contributed to faster directional changes, improved coordination, increased joint range of motion, and greater dynamic flexibility. This aligns with evidence linking the development of flexibility to improved performance outcomes in football players (Bogalho et al., 2022). Furthermore, structured, progressive physical activity has been shown to enhance motor competence in systematic practice environments (Jafar et al., 2023; Dapp et al., 2021).

In addition, game-based and small-sided activity structures are known to support decision-making and the development of agility by simulating realistic sporting environments (Coutinho et al., 2022; Young et al., 2022). Broader evidence also indicates that participation in organized sports can contribute to motor development when appropriately structured, although the magnitude of these effects may vary depending on program design and participant characteristics (Schucan Bird et al., 2013; Abusleme-Allimant et al., 2023).

However, while the findings indicate positive effects of the intervention, they should be interpreted cautiously, given the study design and sample size. Similar studies have reported more modest or variable improvements in motor outcomes following recreational or game-based training, suggesting that effects may depend on program duration, intensity, and baseline performance levels (Young et al., 2022; Kulik et al., 2019). These differences highlight that recreational training is not uniformly effective across all contexts and populations. Overall, the results suggest that guided recreational training can function as a developmentally supportive approach rather than merely a leisure activity. Carefully structured programs that integrate skill development with enjoyable activities may support motor and athletic development while also offering practical implications for coaches seeking to enhance engagement and performance in adolescent athletes (Cushion et al., 2012; Liu et al., 2025).

Research Contribution

The present findings extend previous research demonstrating that structured physical activity programs can improve motor competence in youth populations. While prior studies have primarily focused on general youth or school-based interventions, the current study provides evidence that integrating guided recreational elements into football-specific training can yield measurable improvements in agility, flexibility, and coordination (Moon et al., 2024; Dapp et al., 2021). This highlights the potential value of combining skill-focused training with enjoyable, game-based activities to support engagement and motor learning outcomes. The results also align with contemporary perspectives emphasizing variability, adaptability, and ecological task design in sport performance development (Young et al., 2022; Coutinho et al., 2022).

Limitations

Despite the strengths of this study, several limitations should be acknowledged. First, participant blinding was not implemented, which may introduce expectancy effects. Second, reliance on time-based performance measures without qualitative analysis of movement patterns limits interpretive depth (Williams et al., 2004). Third, the sample consisted exclusively of 16-year-old male football players, limiting generalizability to other age groups, sports, and female populations (Schucan Bird et al., 2013). Fourth, motivational factors were inferred rather than directly measured; therefore, any interpretation regarding engagement or motivation should be considered speculative rather than conclusive (Wulf & Lewthwaite, 2016; Brenner & Watson, 2024). Finally, external variables such as nutrition, sleep, and additional physical activity were not controlled, which may have influenced the results.

Suggestions

Future research should expand on these findings by examining how variations in program intensity, duration, and task complexity influence motor skill development across different populations (Moon et al., 2024; Dapp et al., 2021). Comparative studies between male and female participants would help clarify potential gender-related differences in responsiveness to recreational training interventions (Kulik et al., 2019). In addition, incorporating more precise measurement tools such as motion capture systems or wearable sensors, along with qualitative assessments of movement quality, could provide deeper insight into neuromuscular adaptations and technique improvements (Bing et al., 2023). Finally, longitudinal research is recommended to examine the sustainability of performance gains over time and to better understand long-term training effects in youth sport development (Wulf & Lewthwaite, 2016; Brenner & Watson, 2024).

CONCLUSION

The present study suggests that a guided recreational training program may contribute to improvements in motor performance among 16-year-old youth football players, particularly in agility, flexibility, and coordination. The comparison between the experimental and control groups indicates a positive effect of the intervention; however, these findings should be interpreted with caution in light of the study design and sample size. Overall, the results support the potential value of incorporating structured and enjoyable training methods into youth football programs as a complementary approach to traditional training, which may enhance motor skill development in a developmentally appropriate manner. From a practical perspective, these findings may be useful for coaches and physical education practitioners in designing engaging training environments that support motor learning and participation in adolescent athletes without overgeneralizing the strength of the observed effects.

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AUTHOR CONTRIBUTION STATEMENT

LR, AA, SA, AAA, MHSO, HH, FA, and WR contributed to the study's conception and design. LR, AA, and WR conducted data collection. SA, AAA, MHSO, and HH performed data analysis and interpretation. FA and WR drafted the manuscript. All authors contributed to the critical revision of the manuscript for important intellectual content and approved the final version of the manuscript.

AI DISCLOSURE STATEMENT

The authors declare that ChatGPT, an AI language model developed by OpenAI, was used solely to improve the language, grammar, and clarity of the manuscript. The assistance provided by the AI was limited to enhancing readability, correcting grammatical errors, and refining sentence structures. All ideas, analyses, interpretations, and academic content are the authors' own. The use of ChatGPT was restricted to linguistic and stylistic improvements and did not contribute to the generation of intellectual content.

CONFLICTS OF INTERES

On behalf of all authors, the corresponding author states that there is no conflict of interest.

REFERENCES

Abusleme-Allimant, R., Hurtado-Almonacid, J., Reyes-Amigo, T., Yáñez-Sepúlveda, R., Cortés-Roco, G., Arroyo-Jofré, P., & Páez-Herrera, J. (2023). Effects of structured and unstructured physical activity on gross motor skills in preschool students to promote sustainability in the physical education classroom. *Sustainability*, 15(13), 10167. https://doi.org/10.3390/su151310167

Al-Hakim, A. S. J. (2014). Testing, measurement, and statistics in the field of sports (1st ed.). *University of Al-Qadisiyah*.

Anderson, D. I., Lohse, K. R., Lopes, T. C. V., & Williams, A. M. (2021). Individual differences in motor skill learning: Past, present, and future. *Human Movement Science*, 78, 102818. https://doi.org/10.1016/j.humov.2021.102818

Araujo, R. H., Werneck, A. O., Martins, C. L., Barboza, L. L., Tassitano, R. M., Aguilar-Farias, N., ... & Silva, D. R. (2024). Global prevalence and gender inequalities in at least 60 min of self-reported moderate-to-vigorous physical activity 1 or more days per week: an analysis with 707,616 adolescents. *Journal of Sport and Health Science*, 13(5), 709-716.. https://doi.org/10.1016/j.jshs.2023.10.011

Bates, S., Greene, D., & O'Quinn, L. (2021). Virtual sport-based positive youth development during the COVID-19 pandemic. *Child and Adolescent Social Work Journal*, 38(4), 437–448. https://doi.org/10.1007/s10560-021-00774-9

Bing, Z., Rohregger, A., Walter, F., Huang, Y., Lucas, P., Morin, F. O., ... & Knoll, A. (2023). Lateral flexion of a compliant spine improves motor performance in a bioinspired mouse robot. *Science Robotics*, 8(85), eadg7165.. https://doi.org/10.1126/scirobotics.adg7165

Bogalho, D., Gomes, R., Mendes, R., Dias, G., & Castro, M. A. (2022). Impact of flexibility on vertical jump, balance, and speed in amateur football players. *Applied Sciences*, 12(11), 5425. https://doi.org/10.3390/app12115425

Brenner, J. S., & Watson, A. (2024). Overuse injuries, overtraining, and burnout in young athletes. Pediatrics, 153(2), e2023065129. https://doi.org/10.1542/peds.2023-065129

Carbone, P. S., Smith, P. J., Lewis, C., & LeBlanc, C. (2021). Promoting the participation of children and adolescents with disabilities in sports, recreation, and physical activity. *Pediatrics*, 148(6). https://doi.org/10.1542/peds.2021-054664

Coutinho, D., Gonçalves, B., Santos, S., Travassos, B., Folgado, H., & Sampaio, J. (2022). Exploring how limiting the number of ball touches during small-sided games affects youth football players' performance across different age groups. *International Journal of Sports Science & Coaching*, 17(3), 545–557. https://doi.org/10.1177/17479541211037001

Cushion, C., Ford, P. R., & Williams, A. M. (2012). Coach behaviours and practice structures in youth soccer: Implications for talent development. *Journal of sports sciences*, 30(15), 1631-1641. https://doi.org/10.1080/02640414.2012.721930

Dapp, L. C., Gashaj, V., & Roebers, C. M. (2021). Physical activity and motor skills in children: A differentiated approach. *Psychology of Sport and Exercise*, 54, 101916. https://doi.org/10.1016/j.psychsport.2021.101916

Dorsch, T. E., Smith, A. L., Blazo, J. A., Coakley, J., Côté, J., Wagstaff, C. R., ... & King, M. Q. (2022). Toward an integrated understanding of the youth sport system. *Research quarterly for exercise and sport*, 93(1), 105-119.. https://doi.org/10.1080/02701367.2020.1810847

Hassanein, M. S. (2013). Measurement and evaluation in physical education and sports. *Dar Al-Fikr Al-Arabi*.

Jafar, M., Rinaldy, A., & Yunus, M. (2023). Improving student motor skills through a structured physical training program. *Journal of Advances in Sports and Physical Education*, 6(05), 82-95. https://doi.org/10.36348/jaspe.2023.v06i05.003

Jebur, W. R., Ali, A. H., Atiyah, A. S., & Obed, M. H. S. (2024). Design and standardization of a device to measure attentional control for futsal players. *International Journal of Human Movement and Sports Sciences*, 12(1), 246–254. https://doi.org/10.13189/saj.2024.120126

Jebur, W. R., Kazim, N., Al-Kikani, S. A. A., Obed, M. H. S., & Oudaa, A. A. K. (2025). Developing multiple intelligences, passing accuracy, and ball control skills through a differentiated learning strategy in female students. *Pedagogy of Physical Culture and Sports, 29*(5), 389–398. https://doi.org/10.15561/26649837.2025.0502

Kulik, K. S., Brewer, H. J., & Baker, J. S. (2019). The effect of demographic factors on the implementation of quality physical education. *Journal of Physical Education and Sports Management*, 6(2), 1–13. https://doi.org/10.15640/jpesm.v6n2a1

Liu, B., Yan, Y., Jia, J., & Liu, Y. (2025). Can active play replace skill-oriented physical education in enhancing fundamental movement skills among preschool children? A systematic review and meta-analysis. *BMC Public Health*, 25(1), 1399. https://doi.org/10.1186/s12889-025-22398-9

Moon, J., Webster, C. A., Stodden, D. F., Brian, A., Mulvey, K. L., Beets, M., ... & Russ, L. (2024). Systematic review and meta-analysis of physical activity interventions to increase elementary children’s motor competence: a comprehensive school physical activity program perspective. *BMC public health*, 24(1), 826. https://doi.org/10.1186/s12889-024-18145-1

Persson, M. (2023). Playing without goals: Gendered practices in recreational youth football. *Journal of Youth Studies*, 26(5), 577-592. https://doi.org/10.1080/13676261.2021.2022641

Șandra, M., Bulz, G. C., & Marinău, M. A. (2022). The development of speed, agility and coordination in young football players of the U12 category. *Geosport for Society*, 17(2), 75-88. https://doi.org/10.30892/gss.1702-085

Schmidt, R. A., Lee, T. D., Winstein, C. J., Wulf, G., & Zelaznik, H. N. (2018). Motor control and learning: A behavioral emphasis (6th ed.). *Human Kinetics* .

Schucan Bird, K., Tripney, J., & Newman, M. (2013). The educational impacts of young people's participation in organised sport: A systematic review. *Journal of Children's Services*, 8(4), 264–275. https://doi.org/10.1108/JCS-04-2013-0014

Vincent, H. K., Brownstein, M., & Vincent, K. R. (2022). Injury prevention, safe training techniques, rehabilitation, and return to sport in trail runners. *Arthroscopy, Sports Medicine, and Rehabilitation*, 4(1), e151–e162. https://doi.org/10.1016/j.asmr.2021.09.032

Wik, E. H. (2022). Growth, maturation and injuries in high-level youth football (soccer): A mini review. *Frontiers in Sports and Active Living*, 4, 975900. https://doi.org/10.3389/fspor.2022.975900

Williams, A. M., Hodges, N. J., & Scott, M. A. (2004). Skill acquisition in sport: Research, theory and practice. *Routledge* .https://doi.org/10.4324/9780203646564

Wulf, G., & Lewthwaite, R. (2016). Optimizing performance through intrinsic motivation and attention for learning: The optimal theory of motor learning. *Psychonomic Bulletin & Review*, 23(5), 1382–1414. https://doi.org/10.3758/s13423-015-0999-9

Young, W., Dos' Santos, T., Harper, D., Jefferys, I., & Talpey, S. (2022). Agility in invasion sports: Position stand of the IUSCA*. International Journal of Strength and Conditioning*, 2(1). https://doi.org/10.47206/ijsc.v2i1.126