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Research Article

Effect of a 12-week Skill Training Programme on the Health-related Components of Physical Fitness of Secondary School Female Football Players in Benue State, Nigeria

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Abstract

Physical fitness and skills are critical determinants of performance in football, particularly for female players at the secondary school level. This study aimed to assess the effect of a 12-week skill training programme on health-related components of physical fitness in secondary school female football players in Benue State, Nigeria. A quasi-experimental pretest-posttest control group design was employed. Fifty-eight female football players participated in the study, comprising two experimental groups and a control group. Aerobic fitness was assessed using the PACER test, body composition through BMI, flexibility via the sit-and-reach test, and muscular strength and endurance using push-up and squat tests, respectively. The training intervention was conducted three days per week for 12 weeks. Data were analyzed using independent samples t-tests at a 0.05 significance level. The 12-week skill training programme significantly improved aerobic fitness ($t(56) = 7.096$, $p = .001$), flexibility ($t(56) = 2.604$, $p = .012$), and muscular strength ($t(56) = 2.857$, $p = .006$). No significant effects were observed for body composition ($t(56) = 1.301$, $p = .198$) and muscular endurance ($t(56) = .910$, $p = .367$). It was concluded that the 12-week skill training programme was effective in enhancing aerobic fitness, flexibility, and muscular strength but did not significantly impact body composition or muscular endurance. The findings highlight the need for integrating periodized endurance training alongside skill drills to optimize overall fitness in female football players.

Keywords

Skill Training, Physical Fitness, Football, Female, Secondary School

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1. Introduction

Physical fitness and technical skills are integral to the performance of football players, with both components playing distinct yet interrelated roles in optimizing on-field performance. The ability to execute technical skills with precision is often contingent upon a player's physical condition, underscoring the importance of comprehensive training programs that address both fitness and skill development. This relationship is particularly evident in football, where maintaining optimal fitness levels enhances technical execution and tactical decision-making.

Globally, there has been a growing emphasis on identifying and nurturing young athletic talent, particularly in football, through structured training academies and specialized development programmes [1]. However, in Nigeria, particularly in Benue State, the establishment of such targeted programmes for female football players remains limited. Despite the global rise in female football participation, Nigeria's national female football team, the Super Falcons, has yet to achieve significant international success. While they have dominated the African football scene with 11 championship titles since 1991, their performance at the Fédération Internationale de Football Association (FIFA) Women's World Cup has been inconsistent, with several early exits and high-margin defeats, including an 8-0 loss to Norway in 1995, a 7-1 defeat to the USA in 1999, and a 5-0 loss to the USA in 2003 [2]. In 2023, the Super Falcons exited the tournament at the round of 16, highlighting the urgent need for targeted developmental programmes to improve player performance [2].

Secondary schools represent a crucial platform for identifying and nurturing young female football talent in Nigeria, yet grassroots programmes remain underdeveloped. Several studies have demonstrated the effectiveness of skill training programmes in enhancing physical fitness and performance in football players [1, 3-7]. However, there is a paucity of research examining the specific impact of structured skill training programmes on female football players in Nigeria, particularly in Benue State. Addressing this gap, the present study assessed the effect of a 12-week skill training programme on the health-related physical fitness components of secondary school female football players in Benue State, Nigeria.

2. Materials and Methods

2.1. Study Design and Participants

A quasi-experimental pretest-posttest control group design was employed in this study. The population consisted of 222 female secondary school football players from twelve secondary schools that participated in the All-Secondary School Games in January 2024 in Makurdi, Benue State, Nigeria. A simple random sampling technique was employed to select three schools from this population. All female players from each of the three randomly selected schools who participated in the competition were included in the study, resulting in a total sample size of 58 participants. To minimize disruption to academic schedules, an intact group sampling method was used within each selected school. This involved including all eligible participants from each selected school without further selection or stratification. After the three schools were selected, they were randomly assigned to one of three groups: Experimental Group 1 (Vaatia College Makurdi, n = 20), Experimental Group 2 (Peniel College, Makurdi, n = 18), and Control Group (Bright Star Academy, Makurdi, n = 20). This random assignment helped reduce selection bias and improve the internal validity of the study.

2.2. Intervention

The intervention consisted of a 12-week skill training programme with three training sessions per week. The training regimen was adapted from Sharma & Rawat [8] and Edu & Sports Ertheo [9]. The drills and their progression included:

Experimental Group 1: Passing (ground kicks, stationary ball accuracy), Shooting (stationary shooting, kick-offs), Dribbling (zigzag runs, figure-8-dribbling), Trapping (rolling ball, aerial ball), Heading (up and down, heading in '3'), and Throw-in (short and long throw-ins).

Experimental Group 2: Passing (cone passing, short to long passes), Shooting (pass and shoot, turn and shoot), Dribbling (suicide dribbling, 1v1 controlled scoring), Trapping (cone drills, receiving throw-ins), Heading (run in and head, throw-head-catch), and Throw-in (short and long throw-ins).

Both groups participated in soccer skill development interventions, but each was exposed to different training approaches to examine the effects of varied instructional methods on fundamental soccer skills. Experimental Group 1 followed a more technique-oriented training model, emphasizing isolated drills. Experimental Group 2 received a more game-like, dynamic approach, incorporating contextual and integrated drills. This division allows for the evaluation of which training method better enhances performance outcomes in youth soccer.

Training intensity progressed as follows: Weeks 1-4 at 50-60% intensity, Weeks 5-8 at 60-70% intensity, and Weeks 9-12 at 70-85% intensity. Sessions were conducted on Tuesdays (passing and shooting), Thursdays (dribbling and trapping), and Saturdays (heading and throw-in) from 5:00 to 6:30 pm.

2.3. Outcome Measures

2.3.1. Aerobic Fitness

Assessed using the Progressive Aerobic Cardiovascular Endurance Run (PACER) test. The number of completed laps

was recorded and converted to VO2max using the equation: VO2max = 41.77 + (0.49 × PACER laps) - (0.0029 × PACER laps ³) - (0.62 × BMI) + (0.35 × age × gender), where gender: male = 1, female = 0.

2.3.2. Body Composition

Assessed using Body Mass Index (BMI), calculated as body mass (kg) divided by height (m ²), in accordance with the protocol of the International Society for the Advancement of Kinanthropometry [10].

2.3.3. Flexibility

Assessed using the sit-and-reach test. Participants performed the test using a standard sit-and-reach box. The farthest point reached was recorded to the nearest centimeter.

2.3.4. Muscular Strength

Assessed using the push-up test. Participants performed push-ups for one minute, and the number of correctly executed repetitions was recorded.

2.3.5. Muscular Endurance

Assessed using the squat test. Participants performed squats for one minute, and the number of correctly executed repetitions was recorded.

2.4. Data Analysis

Data were analyzed using independent samples t-tests to compare the pretest and posttest scores of the experimental and control groups. Multiple t-tests were conducted to compare the mean scores of Experimental Group 1 and the control group, and Experimental Group 2 and the control group. Data analysis was performed using SPSS version 21 at a 0.05 level of significance.

3. Results

The results of the 12-week skill-training programme on the health-related components of physical fitness among female football players in Benue State, Nigeria, are presented in Tables 1-3. Prior to conducting the t-test, assumptions of normality and homogeneity of variance were assessed to ensure the appropriateness of the analysis using the Kolmogorov-Smirnov test. The results indicated that the data were normally distributed ($p > 0.05$), satisfying the assumption of normality.

3.1. Physical Fitness Components of Experimental Group and Control Group

Table 1 presents the t-test analysis comparing the overall experimental group and the control group. Significant improvements were observed in aerobic fitness ($t(56) = 7.096$, $p = 0.001$), flexibility ($t(56) = 2.604$, $p = 0.012$), and muscular strength ($t(56) = 2.857$, $p = 0.006$). No significant effects were found for body composition ($t(56) = 1.301$, $p = 0.198$) and muscular endurance ($t(56) = 0.910$, $p = 0.367$).

Table 1. *Comparison of Physical Fitness Components between Experimental Group and Control Group (n = 58).*

Physical Fitness Components	Experimental Group (n = 38)		Control Group (n = 20)		df	t	Sig
	Pretest	Posttest	Pretest	Posttest			
Aerobic Fitness (PACER)	32.56±3.16	35.42 ±3.73	28.00±3.49	28.45 ±3.19	56	7.096	0.001
Body Composition (BMI)	20.37±3.34	20.03 ±3.32	21.21±2.92	21.18 ±2.89	56	1.301	0.198
Flexibility (Sit and Reach)	11.89±1.41	12.87 ±1.40	11.65±1.31	11.95 ±1.00	56	2.604	0.012
Muscular Strength	14.39±2.43	15.34 ±2.22	13.55±1.47	13.80 ±1.28	56	2.857	0.006
Muscular Endurance	11.76±2.16	12.63 ±2.19	12.00±2.18	12.10 ±2.00	56	0.910	0.367

3.2. Physical Fitness Components of Experimental Group 1 and Control Group

Table 2 illustrates the t-test analysis comparing Experimental Group 1 and the control group. Experimental Group 1 showed significant improvements in aerobic fitness ($t(38) = 10.074$, $p = 0.001$), flexibility ($t(38) = 4.275$, $p = 0.001$), and muscular strength ($t(38) = 3.104$, $p = 0.004$). Body composition and muscular endurance did not show significant differences ($p > 0.05$).

Table 2. Comparison of Physical Fitness Components between Experimental Group 1 and Control Group (n = 40).

Physical Fitness Components	Experimental Group 1 (n = 20)		Control Group (n = 20)		df	t	Sig
	Pretest	Posttest	Pretest	posttest			
Aerobic Fitness (PACER)	33.75 ±3.09	37.95 ± 2.76	28.00 ±3.49	28.45 ± 3.19	38	10.074	0.001
Body Composition (BMI)	19.38 ±3.72	19.20 ± 3.48	21.21 ±2.92	21.18 ± 2.89	38	1.955	0.058
Flexibility (Sit and Reach)	11.95 ±1.36	13.50 ± 1.28	11.65 ±1.31	11.95 ± 1.00	38	4.275	0.001
Muscular Strength	14.75 ±3.02	15.85 ± 2.66	13.55 ±1.47	13.80 ± 1.28	38	3.104	0.004
Muscular Endurance	11.50 ±2.16	12.95 ± 2.28	12.00 ±2.18	12.10 ± 1.97	38	1.261	0.215

3.3. Physical Fitness Components of Experimental Group 2 and Control Group

Table 3 presents the t-test analysis comparing Experimental Group 2 and the control group. Significant improvements were observed in aerobic fitness ($t(36) = 4.488$, $p = 0.001$) and muscular strength ($t(36) = 2.185$, $p = 0.035$). However, there were no significant differences in flexibility, body composition, or muscular endurance ($p > 0.05$).

Table 3. Comparison of Physical Fitness Components between Experimental Group 2 and Control Group (n = 38).

Physical Fitness Components	Experimental Group 2 (n = 18)		Control Group (n = 20)		df	t	Sig
	Pretest	Posttest	Pretest	Posttest			
Aerobic Fitness (PACER)	31.28 ±2.76	32.61 ± 2.43	28.00 ±3.49	28.45 ± 3.19	36	4.488	0.001
Body Composition (BMI)	21.46 ±3.54	20.96 ± 2.95	21.21 ±2.92	21.18 ± 2.89	36	0.227	0.821
Flexibility (Sit and Reach)	11.83 ±1.50	12.17 ± 1.20	11.65 ±1.31	11.95 ± 1.00	36	0.607	0.548
Muscular Strength	14.00 ±1.53	14.78 ± 1.48	13.55 ±1.47	13.80 ± 1.28	36	2.185	0.035
Muscular Endurance	12.06 ±2.18	12.28 ± 2.08	12.00 ±2.18	12.10 ± 1.97	36	0.270	0.788

Overall, the results indicate that the 12-week skill training programme significantly improved aerobic fitness and muscular strength in both experimental groups. Flexibility showed significant improvements in Experimental Group 1 but not in Experimental Group 2. Body composition and muscular endurance did not show significant differences in any group.

4. Discussion

The findings of this study demonstrate that a 12-week skill training programme significantly improved aerobic fitness, flexibility, and muscular strength among female secondary school football players in Benue State, Nigeria. These results align with existing literature, reinforcing the efficacy of structured skill-based training in enhancing specific components of physical fitness in female athletes.

The observed improvement in aerobic fitness ($t(56) = 7.096$, $p = 0.001$) supports previous studies that emphasize the positive impact of targeted training on cardiovascular endurance. Ramirez-Campillo et al. [11] reported that plyometric training protocols lasting six weeks or longer effectively enhance aerobic capacity in female athletes. Similarly, Nikolaidis et al. [12] found that skill-based training regimens significantly increase aerobic capacity, particularly in adolescent soccer players. The present study's findings extend this evidence by demonstrating that structured skill drills, conducted consistently over 12 weeks, can yield substantial gains in aerobic fitness, even in populations with limited prior training exposure. This underscores the potential for implementing skill drills as a dual-purpose intervention that not only enhances technical skills but also optimizes cardiovascular fitness without the monotony associated with conventional endurance training.

The non-significant effect of the skill training programme

on body composition (t(56) = 1.301, p = 0.198) may be attributed to the nature and intensity of the intervention. Unlike strength and endurance-focused programmes that incorporate high-intensity resistance training, the skill drills in this study primarily targeted technical execution rather than metabolic conditioning. Hernandez-Martin et al. [13] demonstrated that resistance training combined with high-intensity aerobic exercises effectively alters body composition, particularly by increasing lean muscle mass. Conversely, the present study's emphasis on skill drills without structured resistance training likely contributed to the lack of measurable changes in BMI. These findings suggest that for significant alterations in body composition, incorporating targeted resistance training may be necessary alongside skill drills, as evidenced by Roso-Moliner et al. [14], who noted significant reductions in fat mass and increases in lean mass in elite female soccer players following a 10-week neuromuscular training programme.

The significant improvement in flexibility (t(56) = 2.604, p = 0.012) among participants aligns with findings by Ari and Çolakoğlu [15], who observed notable gains in range of motion following a 12-week plyometric training protocol. Skill drills involving dynamic movements, such as dribbling and zigzag runs, may have contributed to the enhanced flexibility observed in the present study. Furthermore, Adlof et al. [7] emphasized that structured training protocols that incorporate stretching and mobility exercises effectively increase flexibility in female soccer players. The present study's findings underscore the importance of integrating sport-specific drills that inherently promote joint mobility and muscle elasticity, thus serving as a multifaceted training stimulus that not only improves technical execution but also augments overall physical fitness.

Muscular Strength: The significant enhancement in muscular strength (t(56) = 2.857, p = 0.006) aligns with existing literature on the efficacy of skill-based training for strength development. Belachew and Mengistu [16] demonstrated that sport-specific drills incorporating resistance exercises significantly improve muscular strength in male football players. Similarly, Silva et al. [17] reported that regular, progressive training tailored to female athletes effectively enhances muscle mass and strength. The present study's findings are consistent with these conclusions, indicating that even in the absence of conventional resistance training, sport-specific skill drills can serve as an effective strength training stimulus. This is particularly relevant for populations with limited access to gym facilities, suggesting that well-designed skill drills can be an accessible and cost-effective strategy for strength development.

Despite the improvements observed in other fitness components, the skill training programme did not significantly impact muscular endurance (t(56) = 0.910, p = 0.367). This finding is consistent with Ramirez-Campillo et al. [18], who emphasized that skill drills alone are insufficient to elicit adaptations in muscular endurance without incorporating specific endurance training modalities. Granacher et al. [19] similarly noted that periodized endurance training, involving progressively intensified workloads, is essential for improving muscular endurance. The present study's findings suggest that while skill drills are effective for developing strength and aerobic fitness, they may not provide the necessary stimulus to significantly enhance muscular endurance. Integrating high-intensity interval training (HIIT) or specific endurance-focused circuits may be necessary to achieve comprehensive fitness adaptations.

Overall, the findings of this study underscore the efficacy of structured skill training programmes in enhancing key components of physical fitness, particularly aerobic fitness, flexibility, and muscular strength, in female football players. However, the lack of significant effects on body composition and muscular endurance suggests that additional training elements, such as resistance and endurance-focused exercises, may be necessary to achieve comprehensive fitness adaptations. Future research should explore the combined effects of skill drills, resistance training, and HIIT to determine optimal training protocols for female athletes in similar contexts.

5. Conclusion

The findings of this study indicate that a 12-week skill training programme significantly improved aerobic fitness, flexibility, and muscular strength among female secondary school football players in Benue State, Nigeria. These results underscore the effectiveness of sport-specific skill drills in enhancing key physical attributes relevant to football performance. However, the absence of significant changes in body composition and muscular endurance suggests that skill drills alone may be insufficient to elicit comprehensive fitness adaptations. The incorporation of resistance training and high-intensity interval training (HIIT) may be necessary to achieve more pronounced improvements in these areas. Future studies should explore the combined effects of skill drills, resistance exercises, and endurance training to establish comprehensive training protocols for female athletes.

Abbreviations

FIFA	Fédération Internationale de Football Association
PACER	Progressive Aerobic Cardiovascular Endurance Run
BMI	Body Mass Index

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Author Contributions

Joy Nneoma Akameze: Formal Analysis, Methodology,

Resources, Validation, Writing - review & editing

Andrew Aor Tyoakaa: Conceptualization, Writing - original draft

Donatus Udochukwu Chukwudo: Data curation, Investigation, Supervision

Francis Chibunine Ugwueze: Writing - review & editing

All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Nigeria and approved by the Benue Football Federation (BFA) in conjunction with the Nigeria Football Federation (NFF).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Data are available upon reasonable request from the authors.

Conflicts of Interest

The authors declare no conflicts of interest.

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