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Evaluation on the Level of Functional Movement Screen (FMS) and Functional Training VIS-À-VIS Sprint Performance of College Track and Field Athletes

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Abstract: This study selected 56 sprint student-athletes from the track and field team of Hechi University in Guangxi, China, as test subjects. Before the experiment, all athletes were assessed with the Functional Movement Screen (FMS) test, and a detailed analysis and comparison of the athletes' FMS scores were conducted from an objective perspective. After 12 weeks of functional training intervention, a second FMS test assessment was carried out on the participating athletes. The survey results showed that before the training, the movement quality and functional movement ability of the student-athletes were average. Among them, the scores for core stability, lower limb explosive power, and multi-joint movement tests were evaluated as 3 points, showing excellent core stability and lower limb strength. However, the scores for agility, upper limb coordination, and the 100-meter test were rated as 2, which was average. Before and after training, the overall average score of the Functional Movement Screen (FMS) for the student-athlete respondents increased from 15.4500 to 18.1786, and the t-value was -14.140, indicating a significant difference in functional movement levels before and after training. Participants showed noticeable improvements in flexibility, stability, and overall movement quality after the training intervention. Data from the 100-meter test showed that the average score before training was 2.3571 and post-training was 2.9464, with a calculated t-value of -8.883, indicating a significant difference in sprint performance before and after the training. Therefore, introducing this new theory of FMS into future sprint teaching and training practice can not only help correct athletes' physical function deficits and cultivate correct movement patterns, but it can also serve as an effective complement to track and field training methods, providing a theoretical basis for scientifically-informed coaching.

Keywords: Functional Movement Screening; Functional Training; Sprint Athletes; Sports Performance.

1. Introduction

Functional training has emerged as a pivotal concept in modern sports training. This paradigm accentuates mimicking and enhancing natural movements used in daily life or specific sports, aiming to boost an athlete's overall performance while reducing the risk of injury. Distinct from traditional isolated muscle exercises, functional training emphasizes the coordination and strength of the entire movement chain. Empirical evidence suggests that this training approach can elevate athletes' performance in competitions, especially in events requiring Multi joint and multiplanar movements. Additionally, functional training has permeated general fitness realms, with many enthusiasts adopting this methodology to improve their physical function and injury prevention. With an increasing number of studies underscoring its benefits and the advent of various training tools like stability balls, core sliders, and resistance bands, functional training has witnessed widespread proliferation and application globally.

It has been demonstrated that functional training holds positive implications for enhancing the speed of sprinters. This training mode zeros in on the holistic body movement chain and neuromuscular coordination, rather than mere force production of an isolated muscle group. For sprinters, phases like the start, acceleration, and peak speed necessitate the high-level synergy of multiple joints and muscle groups. Functional training can fortify core stability, augment lower limb explosiveness, and finetune the coordination between stride frequency and length. Recent studies indicate that athletes integrating functional training outshine those relying solely on traditional strength training in terms of speed, reaction time, and agility.

Presently, functional training tailored for sprinters has been seamlessly incorporated into numerous professional training regimes. Continuous research endeavors to discern the optimal training techniques and combinations to maximize its effect on speed augmentation. With technological advancements, such as sensors and motion capture technology, the outcomes of functional training can be quantified and assessed with heightened precision, further propelling advancements in this domain.

The imperative to study the impact of functional training on sprinters' speed elevation stems from its potential to optimize an athlete's comprehensive movement chain. Sprinting transcends mere muscular power; it is about harnessing this power in the most efficient and coordinated manner. Functional training concentrates on enhancing the synergy between various body parts, particularly when replicating actions observed in real competitions. This is paramount for sprinters concerning action efficiency during the start, acceleration, and maintaining peak velocity. Moreover, functional training aids in injury prevention by reinforcing an athlete's core stability and mitigating muscular imbalances. With intensifying competition, securing every edge, no matter how marginal, becomes paramount. Therefore, delving into the specifics of how functional training influences sprinters' speed can pave the way for devising more effective training strategies, subsequently elevating athlete performance.

2. Statement of the Problem

This study aims to determine the relationship between functional training and sprint performance, with the goal of proposing a training framework that can enhance the functional training level and sprint results of track and field athletes. Specifically, the study will seek answer to the following questions:

1.What is the profile of the respondents in terms of

1.1 Age;

1.2 Sex;

1.3 Training years

1.4 Sports level

2. What is the assessment on the level of FMS of the student respondents before the actual training?

2.1 Deep Squat

2.2 Hurdle Step

2.3 In-Line Lunge

2.4 Shoulder Mobility

2.5 Active Straight Leg Raise

2.6 Trunk Stability-Push Up

2.7 Rotary Stability-Quadruped

3. Is there a significant difference on the assessment on the level of FMS of the student respondents when the profile is taken as test factor?

4. What is the assessment on the level of functional training of the student respondents before the actual?

4.1 Core stability training;

4.2 Lower limb explosiveness training;

4.3 Multi-joint movement training;

4.4 Agility training;

4.5 Lower limb strength and endurance training;

4.6 Synchronization training of the trunk and upper limbs;

4.7 Stretching and flexibility training;

5. Is there a significant difference on the assessment on the level of functional training of the student respondents when the profile is taken as test factor?

6. Is there a significant difference on the assessment between the student respondents' level of FMS and functional training before and after the training?

7. Is there a significant difference between the student respondents' functional training and sprint performance before and after the training?

8. What kind of training program can be proposed to improve sprint performance?

3. Scope and Delimitation of Study

The study aims to evaluate the relationship between functional trainings and the speed of track and field sprinters, providing a valid reference basis for enhancing the athletic performance and training standards of the track and field teams in colleges of the Guangxi Zhuang Autonomous Region.

This research primarily focuses only on three dimensions of functional training: upper limb pushpull training, core stability training, and lower limb pushpull training, in conjunction with athletic speed. The study encompasses 35 athletes. Data was collected using survey tools and scrutinized and analyzed using mean values, percentages, Pearson's productmoment coefficient, and variance analysis. The findings serve as a foundation for making informed decisions in track and field instruction and training investment, aiming to elevate the performance levels of track and field athletes.

4. Theoretical Framework

This research is grounded in two theories which will guide and direct the study. These theories are the Human Movement Chain Theory, the Human Movement Pattern Theory, and the Athletic Ability Composition Model.

4.1. Human Movement Chain Theory

Initially proposed by Cook et al., this theory forms the core framework for functional training. It not only views human movement as an interconnected system but also emphasizes the synergistic and dependent interactions among various parts. The "links" in the movement chain are responsible for connecting and coordinating the muscles and joints of the human body, producing a sequenced, efficient movement output. Research suggests that a lack of coordination, the presence of weak links, movement instability, and asymmetry often lead to athletic injuries. In competitive sports, an efficient movement output often requires a well functioning movement chain, maximizing power in a limited time. Functional training focuses on improving an athlete's range and precision of movement, aiming to enhance movement speed under dynamic stability. This ensures athletes can complete required movements swiftly and efficiently during competition. Unlike traditional training methods, which often emphasize high intensity and large movement volumes and can result in injuries, functional training prioritizes athlete recovery and long-term health. It incorporates the principle of supercompensation, ensuring an athlete's skills are consolidated while enhancing athletic performance. From the perspective of the movement chain theory, compared to traditional muscle centric training methods, functional training emphasizes a more holistic approach to movement, effectively addressing the "weak link" issues, thus optimizing training outcomes.

4.2. Human Movement Pattern Theory

Every sport has its unique postures and trajectories. When the human body executes a movement, the central nervous system coordinates, ensuring that muscles, joints, and other tissues respond correctly to the brain's commands. Factors like muscle strength might impact the quality of these movements. Therefore, enhancing control capabilities, such as muscle and joint control, becomes crucial when performing movements. Movement training must consider balance, stability, perception, and coordination to shape appropriate movement patterns. Fundamental human movement patterns, such as squatting, stepping, striding, stretching, lifting, tilting, and rotating, form the basis for various technical actions. Functional training, as a system focused on movement quality, significantly supports the enhancement of reflexive regulatory abilities and proprioceptive capacities, standardizing athletes' foundational movements and increasing movement efficacy. This training method emphasizes the holistic quality of movement, requiring Multi joint and muscle group coordination. Moreover, functional training seeks to reinforce basic movements, ensuring efficient power transmission, subsequently elevating an athlete's performance. Compared to traditional methods, functional training is more targeted and eliminates guesswork.

4.3. Athletic Ability Composition Model

The athletic ability model consists of three layers: basic physical movement abilities, general athletic abilities, and specialized athletic abilities. These layers form a pyramid, progressing from bottom to top. The basic physical movement abilities form the foundation of the pyramid, providing a stable base for athletes. Compared to the general population, athletes require higher standards in stability, flexibility, and precise movement execution. General athletic abilities cover the foundational qualities needed by athletes for specific events, such as speed, power, and agility. Traditional physical training often lacks specificity in training these capabilities, while functional training more aptly meets these needs. Specialized athletic abilities directly influence an athlete's performance and are closely related to the characteristics of the sport. Functional training, with its emphasis on the quality of movement completion, is more apt for enhancing specialized physical fitness. Compared to traditional physical training, which mainly focuses on major muscle group strength, functional training stresses the power and stability of core areas, such as the spine and lumbopelvic region. This helps reduce energy wastage and enhances stability and flexibility. In summary, functional training's emphasis on core areas surpasses traditional training, showcasing its value in physical training.

4.4. Paradigm of Study

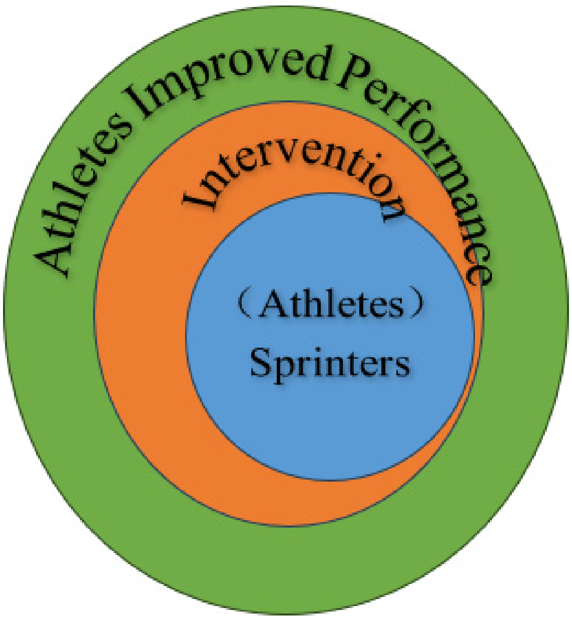

Figure 1. Research Paradigm

The study aims to evaluate the level of importance of functional trainings vis-à-vis actual sprint performance of athletes. First, the profile of respondents and their previous training experience are the input used in the pre-training assessment. Second, the study focuses on the actual trainings to be conducted to student-athletes by the coaches assigned to them. And lastly, the study focuses on the level or degree of training experience and sprint performance of student-athletes. The various facets of functional trainings include core stability training, lower limb explosive strength training, multi joint movement training, agility training, lower limb strength and endurance training, synchronous training of the trunk and upper limbs, as well as stretching and flexibility training. Additionally, sprinting performance metrics, such as the 100meter and 200meter times, are considered. The research will then draw comparisons and establish among these aspects, leading to a proposed guiding framework for sprint training, all aimed at advancing the sprinting performances of athletes.

5. Methodology

This chapter describes the research design and methodology. It also presents the description of the study locale and participants, the data collection instruments and procedure, and the data analysis.

5.1. Research Design

This study utilized both descriptive and experimental methodologies, encompassing both qualitative and quantitative questionnaires. Such a design was selected because it addresses the athletes' profiles and the variables under consideration. The primary objective of the research was to evaluate the level of experience in sports activities and to assess the relationship between athletes' functional training and sprinting performance.

Before the design and commencement of the training experiment, a thorough review of pertinent literature was conducted. This was done to establish the reference indices and the performance metrics that would be monitored and evaluated. The descriptive method was employed to gauge athletes' performance metrics, among other indicators. Following the formulation of the experimental requirements, training sessions were organized, and athletes were encouraged to actively participate. After the training period, the same metrics were retested and the data collected.

For data analysis, the SPSS software was employed to conduct a pre-post experiment paired analysis. This step was instrumental in determining the efficacy of the experiments and the interventions implemented. The results and analyses drawn from the research are anticipated to serve as a reference for planning, preparing, and evaluating athletes' performance.

The descriptive design was deemed the most suitable approach for this study. It is efficient in collecting participant data and offers a comprehensive view of the participants' experiences. In the context of this research, the primary aim was to depict the process of participants' functional training and sprinting performance. The study also sought to understand the relationship between the athletes' training methods, functional training, and sprinting performance progression, offering valuable insights for instructional purposes.

By examining the variables in a structured manner, we provide a more transparent, comprehensive understanding of how functional training potentially influences sprinting performance. This in-depth approach ensures that the research is both significant for its participants and instructive for future athletic training strategies.

5.2. Research Locale and Research Participants

The study is in Hechi University, Guangxi Zhuang Autonomous Region, China. The study population involved are 56 sprinters who completed the relevant high school courses and currently enrolled and athletes in college. This study covers the selected school in the Autonomous Region, China.

Table 1. Participate in the Experimental Athlete Program

Student Athletes	Number of participants
Male	34
Female	22
Total	56

At the same time, interview will be conducted to the 4 coaches in the university in order to qualify the level of importance of physical training vis-à-vis level of sprint performance of student-athletes.

5.3. Sampling Method

This study employed a pedagogical experimental method to survey track and field athletes and coaches at Hechi Academy. Consequently, a comprehensive sampling technique was used, incorporating the existing track and field athletes from Hechi University into this research, organizing and training them as future experimental participants. Since the testing was conducted during Hechi University's prescribed daily training sessions, the functional training and athletic performance they underwent can be evaluated using objective metrics. Simultaneously, this experiment was conducted with parental consent.

5.4. Data Gathering Procedure

Implementing experimental procedures and data collection steps is a crucial stage in ensuring the accuracy and scientific integrity of research findings. Researchers will seek approval to collect relevant data required for the study. Once approved, they will work in collaboration with track athletes and coaches. Before testing, it is essential to ensure that athletes are fully aware of the purpose and detailed procedures of the tests. Data collectors must be properly trained and understand the standard protocols for each test to execute operations and document results accurately. Athletes should be allowed sufficient rest before and after experimental activities to avoid the impact of fatigue on test outcomes. The following is the implementation and data collection protocol used for Functional Movement Screen (FMS) and functional fitness training benchmark testing on 56 sprinters at Hechi University in Guangxi.

5.4.1. Preparation Phase

Select professionals to monitor the testing process and record data to ensure accuracy. Adequately inform participants and make sure they understand the process and purpose of the tests.

5.4.2. Experimental Implementation

Prior to the experiment, conduct health assessments on student-athletes to confirm there are no injury risks. Implement standardized warm-up activities to ensure athletes are in optimal condition for testing. The FMS test consists of seven assessments performed according to the requirements of the FMS scoring system, scored by qualified experts. The seven benchmarks for functional training include Core stability training, Outburst force training, Multi-joint movement training, Agility drill, Lower limb muscle strength and endurance training, Synchronous training of the trunk and upper limbs, Synchronous training of the trunk and upper limbs, using appropriate methods such as timing and counting to record the athletes' abilities. The 100-meter sprint test is conducted under standardized conditions to measure the athlete's time for the 100-meter dash.

5.4.3. Data Recording and Collection

During testing, meticulously record each athlete's test times. Enter all manually recorded data into an Excel spreadsheet for storage and analysis.

5.5. Research Instruments

This study will use a 4-level measurement evaluation method. Before the experiment, FMS assessment was conducted on all athletes, and detailed analysis and comparison of the FMS scores of the athletes were carried out. The short-distance running coaching team objectively evaluated the athletes' physical weaknesses and movement quality, and determined a 12-week functional training program. The content of the functional training included: core stability training, explosiveness training, multi-joint movement training, agility training, lower limb strength and endurance training, synchronization training of the trunk and upper limbs, and stretching and flexibility training. Subsequently, FMS (Functional Movement System) testing equipment was used to assess them both before and after the intervention. The tests included assessments of seven independent basic functional movements: deep squat, hurdle step, inline lunge, shoulder joint flexibility, straight-leg raise, trunk stability push-up, and rotary stability. Each individual test was scored from 0 to 3 points.

5.6. Statistical Treatment of the Data

The results of the survey questionnaire were reviewed and analyzed. The mean score shall indicate the following descriptions:

Quantitative data will be performed statistically and processed using the following statistical tools:

Frequency and percentage ratio. This will be used to describe an overview of participants by gender and department, as well as teacher participants by gender, highest level of education, and length of teaching experience. In addition, these tools will be used to identify the challenges and difficulties faced by athlete participants in functional training and sprint performance development.

Average value. This will be used to determine the level of functional training, athletic performance, etc. The average will be explained using the Likert 4-point system.

T test. This will be used to test whether there is a significant difference in functional training levels between athletes and participants before and after the experiment, in order to determine the timeliness and improvement effect of functional training.

F test. This will be used to test the differences in exercise performance and training effectiveness improvement of athletes with different functional training after the experiment, determine the effectiveness level of different functional training, and provide reference for research.

6. Result and Analysis

6.1. The Profile of the Athlete-Respondents

The following results show the frequency distribution of athlete-respondents' profile variables on age, sex, training years, and sport levels.

Table 2. Frequency Distribution of the Athlete-Respondents' Profile in Terms of Age

Age	Frequency	Percentage
18-19 years old	14	25.0%
20-21years old	28	50.0%
22 years old and above	14	25.0%
Total	56	100%

The table presents a breakdown of athlete-respondents' ages in this study. Among the 56 athlete-respondents, 50.0% are aged 20-21 years old, making it the most represented age group. Additionally, 25.0% of respondents fall into each of the two remaining age categories: 18-19 years old and 22 years old and above. This distribution allows for insights into the demographic composition of the athlete-respondents. The dominance of the 20-21 age group suggests that this cohort might be crucial in determining the relationship between FMS, functional training, and sprint performance among college track and field athletes. Understanding the age distribution is essential as it could influence the study's findings and implications, providing a foundational understanding of how age impacts the variables under investigation.

6.2. The Level of Functional Movement Screen (FMS) of the Athlete-Respondents before the Actual Training.

The Functional Movement Screen (FMS) is a comprehensive assessment tool designed to evaluate an individual's movement patterns, mobility, stability, and functional ability. Developed by physical therapist Gray Cook and strength coach Lee Burton, the FMS consists of seven fundamental movement patterns: Deep Squat, Hurdle Step, In-Line Lunge, Shoulder Mobility, Active Straight Leg Raise, Trunk Stability Push-Up, and Rotary Stability. Each movement pattern is scored on a scale from 0 to 3, with 3 indicating perfect execution and 0 indicating pain or inability to perform the movement.

The FMS test equipment adapted from the results of the research based on the Action Functional Movement Training System (Gray Cook, 2011) was used as a reference for this study. The scoring method was provided to assess the quality of the athlete's movement during the test items.

The scoring criteria used a four-tier system with scores of 0, 1, 2, and 3. The raw score was used to indicate the scores of the left and right sides, while the final score represents the total score of the test. Among the left and right raw scores, the lowest score from one side is taken as the final score for that test item. For example, if a person scores 3 points on the right side and 2 points on the left side, the final score obtained will be 2 points. Then, the final scores were summed up to be used as the total score. An athlete can have a perfect score of 21, while if athletes scored below 14, they may be at risk of injury during athletic training.

As revealed in the table above, the Deep Squat test exhibited an average evaluation score of 3, indicating that athletes can execute the movement correctly and with high quality. Specifically, athletes demonstrated the ability to maintain their upper body parallel to the tibia or vertical, sink the femur below the level, align the knees with the feet, and align the rod with the foot. Similarly, the In-Line Lunge also received an average score of 3, indicating that athletes can maintain contact with the positioning rod, keep it vertical, and maintain a motionless trunk while ensuring alignment between the rod and the foot in the same sagittal plane, with the knee contacting the front side heel.

Table 3. The Level of FMS of the Athlete-Respondents before the Actual Training

Test Indicators			Average Raw Score	Average Final score	Evaluation
1	Deep Squat		2.59	2.59	3
2	Hurdle Step	Left	2.36	2.07	2
		Right	2.20		
3	In-Line Lunge	Left	2.75	2.54	3
		Right	2.70		
4	Shoulder Mobility	Left	2.07	1.93	2
		Right	2.41		
5	Active Straight Leg Raise	Left	2.68	2.46	2
		Right	2.66		
6	Trunk Stability-Push Up		2.05	2.05	2
7	Rotary Stability-Quadruped	Left	1.93	1.80	2
		Right	2.02		
Average Total Score			15.45		

Legend: 3 points -athlete can correctly and with high quality complete the movement; 2 points -athlete can complete the movement with compensation, but the quality of completion is not high; 1 point - athlete cannot complete the entire movement or maintain the initial posture, and 0 points -pain occurs during the test.

Overall, the Hurdle Step, Shoulder Mobility, Active Straight Leg Raise, Trunk Stability Push-Up, and Rotation Stability Quadruped tests all received an average evaluation score of 2. This suggests that athletes can complete the movements with compensation, but the quality of completion is not optimal. For instance, during the Hurdle Step, the hips, knees, and ankles are not aligned straight, and the lumbar spine is noticeably active. In the Shoulder Mobility test, the punch falls within half a hand's reach. In the Active Straight Leg Raise, the vertical line of the ankle joint falls between the middle of the thigh and the line of the knee joint, with the motionless limb remaining in a neutral position. In the Trunk Stability Push-Up, the body is lifted without any spine flexion, with males aligning their thumb with the jaw and females aligning the thumb with the clavicle. Lastly, in the Rotation Stability Quadruped test, athletes can perform the action in the correct oblique direction. These results highlight areas of strength and areas requiring improvement in athletes' functional movement patterns, providing valuable insights for targeted training interventions to enhance sprint performance.

6.3. Differences on the Level of Functional Movement Screen (FMS) of the Athlete-Respondents when grouped according to Profile

Table 4. Differences on the Level of FMS of the Athlete-Respondents when Grouped According to Sex

Performance Indicators	Sex	Mean	SD	Computed t-value	Sig	Decision on Ho	Interpretation
Deep Squat	Male	2.5294	.50664	-1.125	.266	Accept Ho	Not Significant
	Female	2.6818	.47673				
Hurdle Step	Male	2.0294	.30003	-1.218	.229	Accept Ho	Not Significant
	Female	2.1364	.35125				
In-Line Lunge	Male	2.5000	.50752	-.657	.514	Accept Ho	Not Significant
	Female	2.5909	.50324				
Shoulder Mobility	Male	1.6176	.55129	-4.832	.000	Reject Ho	Significant
	Female	2.4091	.66613				
Active Straight Leg Raise	Male	2.3235	.47486	-2.753	.008	Reject Ho	Significant
	Female	2.6818	.47673				
Trunk Stability-Push Up	Male	2.2353	.55371	3.322	.002	Reject Ho	Significant
	Female	1.7727	.42893				
Rotary Stability-Quadruped	Male	1.8529	.43571	1.035	.305	Accept Ho	Not Significant
	Female	1.7273	.45584				
Over-all	Male	15.09	1.485	-2.306	.025	Reject Ho	Significant
	Female	16.00	1.380				

The table presents the differences in the level of Functional Movement Screen (FMS) among athlete-respondents grouped according to sex. The mean scores for each FMS test vary between male and female athletes, indicating potential differences in movement quality. While the Deep Squat, Hurdle Step, and In-Line Lunge tests show no significant differences between males and females, indicating similar movement patterns and quality, significant differences emerge in tests such as Shoulder Mobility, Active Straight Leg Raise, Trunk Stability-Push Up, and Rotary Stability-Quadruped. Female athletes demonstrate higher mean scores in Shoulder Mobility and Active Straight Leg Raise, indicating better movement quality in these tests compared to male athletes. Conversely, male athletes exhibit higher mean scores in Trunk Stability-Push Up, suggesting better trunk stability and upper body strength. Additionally, the overall FMS score for female athletes is significantly higher than that of male athletes, indicating better movement quality and functional ability. However, this contradicts the results of study conducted by Anderson, et. al. (2015) which reveals that female athletes scored lower on Functional Movement Screening (FMS) than their male counterparts, indicating an increased injury risk among the female. Nevertheless, these findings suggest that while both male and female athletes exhibit similar movement patterns in some FMS tests, differences in movement quality and functional ability exist between the sexes, highlighting the importance of sex-specific training interventions to address these disparities and optimize athletic performance. The observed similarities in movement patterns among male and female athletes in certain Functional Movement Screen (FMS) tests imply a degree of universality in basic movement mechanics. However, disparities in movement quality and functional ability between the sexes underscore the need for tailored interventions to optimize athletic performance. These differences may stem from various factors, including anatomical variations, hormonal influences, and individual training histories. Addressing sex-specific differences through targeted training interventions can help athletes overcome biomechanical limitations and enhance movement efficiency, ultimately leading to improved performance outcomes. FMS can detect functional capacity deficiencies, enabling individualized exercise programs. Anderson, et. al. (2015) suggested on exploring FMS task scores' relationship with muscle activation, neuromuscular control, and core stability. By customizing training programs to account for sex-specific needs and optimizing movement patterns, coaches and athletes can work collaboratively to maximize athletic potential and mitigate injury risks. This approach emphasizes the importance of personalized and evidence-based training strategies in fostering athletic success across diverse athlete populations.

6.4. The Level of Functional Training Test of the Athlete-Respondents before the Actual Training

Functional training tests are assessments designed to evaluate an athlete's movement quality, mobility, stability, and overall functional ability in performing various athletic movements. These tests typically involve a series of movement patterns that mimic real-life activities or sports-specific movements, such as squats, lunges, push-ups, and rotational movements. The Functional Movement Screen (FMS) is one example of a widely used functional training test.

The Functional Training Test (FTT) results indicate a mixed level of performance among the athlete-respondents across various test indicators. The Plank Test and Vertical Jump Test reflect excellent performance with scores of 3, suggesting good core stability and lower body power. Similarly, the Back Squat Strength Test demonstrates a commendable strength level, with a score of 3 indicating efficient lower body strength. However, the T-Drill Agility Test and Medicine Ball Chest Pass Distance Test reveal a more general performance level, with scores of 2, indicating room for improvement in agility and upper body power, respectively. Notably, the Single Leg Squat Hold Time Test and Straight Leg Sciatic Nerve Stretch Test show discrepancies between left and right sides, highlighting potential asymmetries or imbalances that may require attention during training.

Table 5. The Level of Functional Training Test of the Athlete-Respondents before the Actual Training

Test Indicators			Average Test score		Evaluation
1	Plank Test		119.46 sec		3
2	Vertical Jump Test		44.55 cm		3
3	Back Squat Strength Test		60 kg	.99%	3
4	T-Drill Agility Test		10.84 sec		2
5	Single Leg Squat Hold Time Test	Left	28.07 sec.	29.36 sec	2
		Right	30.64 sec.		
6	Medicine Ball Chest Pass Distance Test		2.95 meters		2
7	Straight Leg Sciatic Nerve Stretch Test	Left	13.84 cm	13.85 cm	4
		Right	13.86 cm		
8	100 meters		12.69 sec		2

Legend: 4-excellent, 3-good, 2-general, 1-low

6.5. Difference in the Assessment of the Level of FMS of the Athlete-respondents Before and After the Training

Table 6. Difference in the Assessment of the Level of FMS of the athlete-respondents Before and After the Training

Performance Indicators	FMS	Mean	SD	Computed t-value	Sig	Decision on Ho	Interpretation
Deep Squat	Before	2.5893	.49642	-4.731	.000	Reject Ho	Significant
	After	2.9107	.28774				
Hurdle Step	Before	2.0714	.32233	-6.191	000	Reject Ho	Significant
	After	2.4821	.50420				
In-Line Lunge	Before	2.5357	.50324	-5.528	000	Reject Ho	Significant
	After	2.8929	.31209				
Shoulder Mobility	Before	1.9286	.70986	-3.042	004	Reject Ho	Significant
	After	2.1250	.63425				
Active Straight Leg Raise	Before	2.4643	.50324	-5.351	000	Reject Ho	Significant
	After	2.8393	.37059				
Trunk Stability-Push Up	Before	2.0536	.55333	-4.564	000	Reject Ho	Significant
	After	2.4107	.53178				
Rotary Stability-Quadruped	Before	1.8036	.44393	-8.190	000	Reject Ho	Significant
	After	2.5179	50420				
Over-all	Before	15.4500	1.501	-14.140	000	Reject Ho	Significant
	After	18.1786	1.38967				

Table 6 presents a comprehensive assessment of the athlete-respondents' Functional Movement Screen (FMS) scores before and after the training intervention. The results reveal significant improvements across all performance indicators following the training period, as evidenced by the rejection of the null hypothesis (Ho) for each test. Particularly noteworthy are the substantial increases in mean scores for the Deep Squat, Hurdle Step, In-Line Lunge, Shoulder Mobility, Active Straight Leg Raise, Trunk Stability-Push Up, Rotary Stability-Quadruped, and overall FMS score. The rejection of the null hypothesis for each performance indicator indicates that the observed differences in mean scores before and after training are statistically significant, implying that the training intervention had a significant positive impact on the athletes' functional movement proficiency. These findings suggest that the training program effectively targeted various aspects of functional movement, leading to notable enhancements in mobility, stability, and overall movement quality among the athlete-respondents.

The significant improvements in FMS scores underscore the efficacy of the training regimen in addressing movement deficiencies, optimizing movement patterns, and enhancing overall functional fitness among the athletes. Furthermore, the substantial increase in the overall FMS score from 15.4500 before training to 18.1786 after training highlights the comprehensive nature of the improvements across multiple performance indicators. This holistic enhancement in functional movement proficiency is crucial for athletes as it not only contributes to improved athletic performance but also reduces the risk of injury and enhances overall physical conditioning. The observed improvements in FMS scores underscore the importance of structured and targeted training interventions in optimizing movement quality, enhancing functional fitness, and maximizing athletic potential. Overall, the findings of Table 19 highlight the significant positive impact of the training intervention on the athlete-respondents' functional movement proficiency, underscoring the importance of systematic and tailored training regimens in promoting optimal movement patterns and enhancing overall athletic performance.

6.6. Difference in the Assessment of the Level of Functional Training and Sprint Performance of the Athlete-respondents Before and After the Training

Table 7. Difference in the Assessment of the Level of Functional Training Test of the athlete-respondents Before and After the Training

Performance Indicators	FTT	Mean	SD	Computed t-value	Sig	Decision on Ho	Interpretation
Plank Test	Before	3.3393	.47775	-8.883	.000	Reject Ho	Significant
	After	3.9286	25987				
Vertical Jump Test	Before	3.0536	.51943	-8.563	.000	Reject Ho	Significant
	After	3.6250	.48850				
Back Squat Strength Test	Before	3.3571	.48349	-7.686	.000	Reject Ho	Significant
	After	3.8750	33371				
T-Drill Agility Test	Before	2.2857	.45584	-5.780	.000	Reject Ho	Significant
	After	2.6964	.50162				
Single Leg Squat Hold Time Test	Before	2.3929	.49281	-6.937	.000	Reject Ho	Significant
	After	2.8929	.45442				
Medicine Ball Chest Pass Distance Test	Before	2.0357	.18726	-5.105	.000	Reject Ho	Significant
	After	2.3571	.48349				
Straight Leg Sciatic Nerve Stretch Test	Before	4.0000	.00000	-	-	Accept Ho	Not Significant
	After	4.0000	.00000				
100 meters	Before	2.3571	.48349	-8.883	.000	Reject Ho	Significant
	After	2.9464	.40089				

The results of Table 7 illustrate significant improvements in the athlete-respondents' functional abilities across various performance indicators following the training intervention. Each performance indicator, including the Plank Test, Vertical Jump Test, Back Squat Strength Test, T-Drill Agility Test, Single Leg Squat Hold Time Test, Medicine Ball Chest Pass Distance Test, and 100 meters sprint, showed a statistically significant increase in mean scores after the training period. These improvements indicate enhancements in core strength, power, agility, lower body strength, balance, upper body strength, and sprinting speed, respectively. The rejection of the null hypothesis (Ho) suggests that the observed differences in mean scores before and after training are unlikely to be due to random chance.

Notably, the Plank Test, Vertical Jump Test, Back Squat Strength Test, and 100 meters sprint demonstrated particularly pronounced improvements, with mean scores increasing from 3.3393 to 3.9286, 3.0536 to 3.6250, 3.3571 to 3.8750, and 2.3571 to 2.9464, respectively. These findings highlight the efficacy of the training program in enhancing overall functional fitness and athletic performance among the athlete-respondents. The significant improvements across multiple performance indicators suggest that the training regimen effectively targeted various aspects of functional fitness, leading to comprehensive enhancements in strength, power, agility, balance, and speed. These improvements are crucial for athletes across different sports disciplines, as they directly contribute to improved athletic performance, reduced injury risk, and enhanced overall physical conditioning. Functional Training emphasizes the holistic and coordinated nature of the whole body, helping athletes maintain dynamic stability during high-intensity training or competition, thus reducing the risk of injuries (McDougle, 2023).

Furthermore, the observed improvements in functional abilities underscore the importance of structured and targeted training interventions in optimizing athletic performance and achieving peak physical fitness. Overall, the findings emphasize the effectiveness of the training program in eliciting significant improvements in the athlete-respondents' functional abilities, highlighting the importance of systematic and tailored training regimens in maximizing athletic potential and overall physical performance.

6.7. Implement a Training Program to Improve Sprinting Skills and Speed

Table 8. Training Plan Matrix to Improve Sprint Performance

Week/ Frequency	Activity	Objective	Explanation
1-2	Explosive Strength Training	Lower Limb Explosive Power	Improve lower limb strength and explosiveness through exercises like squat jumps and box jumps.
1-2	Core Stability Training	Core Stability	Strengthen core muscle groups through planks, Russian twists, etc.
1-2	Interval Running Training	Speed Endurance	Increase speed endurance via short rests after 300-meter sprints.
2-3	Technical Training	Sprint Techniques	Focus on the start technique and frequency increase, optimize running posture.
1	Combined Training	Overall Improvement	Combine all the above elements, conduct simulated competitions and specific scenario training.

To improve sprinting performance, researchers interviewed four sprint coaches from Hechi University in Guangxi, focusing on how to implement targeted functional training plans, set goals, and utilize training matrices. At the same time, an objective assessment was made of the athletes' potential physical weaknesses and performance. Based on this information, a series of targeted training intervention strategies were proposed.

Through the above training plan, the goal is to significantly improve the athletes' sprint performance within 12 weeks, especially their abilities in acceleration from the start and maintaining top speed. First is to enhance lower limb explosive power, which is critical for sprint starts and acceleration. It improves efficiency during the start and acceleration phases. Next is to improve core stability, which helps maintain effective running posture and reduce energy waste. It enhances the ability to transfer energy and increase the stability of the running posture. Lastly is to increase speed endurance, which ensures that athletes can maintain close to the maximum speed throughout the sprint. By increasing speed endurance, the ability to sustain high speeds over the entire sprint distance is improved. Moreover, technical refinement in sprint techniques, such as starting, stride, and transition, is conducted to improve the motion efficiency of sprint athletes.

7. Conclusion

1. The respondents were mainly in the age group of 20-21 years old, with the majority being males with 2-3 years of training experience. This group is categorized as having an intermediate level of training experience and a lower competitive level.

2. The comprehensive assessment of the Functional Movement Screening (FMS) and Functional Training Test (FTT) before training indicates that the training should focus on improving movement quality and technical execution to enhance overall functional movement capacity.

3. Gender differences impacted the assessment results of the FMS, with females outperforming males in certain tests, which suggests that gender factors should be considered when designing training plans due to their potential impact on training effectiveness.

4. After functional training, there was a significant improvement in the overall FMS scores of student athletes. Results from the FTT also improved, with the significant enhancement in the 100-meter sprint further demonstrating the positive role of FT on the athletes' speed and power performance.

5. Functional training plays a key role in improving the physical fitness and technical performance of young athletes. Future training programs should focus more on enhancing agility, upper body strength, and the quality of movement execution, while taking into consideration the specific impact of gender differences on training outcomes.

6. Functional training has been proven to be an effective means of optimizing the physical performance of young athletes, which is extremely beneficial for their future sports careers and competitive performance.

8. Recommendations

1. Although this study did not find age, training duration, and competition level to be significant factors affecting FMS and FTT scores, future research could consider including a broader and more balanced distribution of participants across age and gender to explore the subtle effects that these factors may hold.

2. Gender played an important role in FMS scoring, suggesting that future training programs should pay closer attention to the specific needs of male and female athletes, such as strengthening core stability training for female athletes and focusing on shoulder mobility and lower limb flexibility training for male athletes.

3. The low scores athletes received in tests like the hurdle, shoulder mobility, and others indicate a need for improvement in movement technique and quality of completion. It is recommended to incorporate more targeted training and instructional components to enhance movement quality, thereby maximizing the enhancement of functional movement capabilities.

4. While exhibiting outstanding core stability and lower limb power, there should be a focus on improving agility and upper limb strength. This can be achieved through a varied training regimen, such as incorporating balance training, reaction speed exercises, and upper limb resistance work.

5. The FTT results indicate that athletes performed excellently in terms of core stability and lower limb explosive strength. Future training should maintain these strengths while also applying real-time monitoring and timely adjustments to the training plan based on changes in FMS and FTT scores, in order to continuously promote the balanced development of overall physical fitness and skills.

6. Given the significant increase in total FMS scores and improvements across various functional training benchmarks post-training, it is recommended to continue employing and optimizing functional training as an important means of enhancing athlete's physical fitness and technical levels.

7. Considering the significant statistical differences before and after training as evidenced by FMS and FTT, future research is advised to use a larger sample size, and to try combining functional training with other types of training, in order to investigate the best methods and combinations for training.

8. Although the study points out improvements in the 100-meter sprint performance of athletes before and after training, it is

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