การพัฒนาโปรแกรมการฝึก เอส เอ คิว ร่วมกับโปรแกรมฝึกความอ่อนตัวที่มีต่อความเร็วและความคล่องแคล่วว่องไวของนักกีฬาฟุตบอล

The Development of SAQ and Flexibility Training Programs on the Speed and Agility of Football Players

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บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อพัฒนาโปรแกรมการฝึกเอส เอ คิว ร่วมกับโปรแกรมฝึกความอ่อนตัว และศึกษาผลของโปรแกรมต่อความเร็วและความคล่องแคล่วว่องไวของนักกีฬาฟุตบอล โดยใช้รูปแบบการวิจัยและพัฒนา แบ่งเป็น 2 ระยะ ระยะที่ 1 เป็นการศึกษาเชิงพรรณนาและสำรวจสภาพจริง เก็บรวบรวมข้อมูลภาคสนามจากผู้ฝึกสอนฟุตบอล 5 คน และนักกีฬาฟุตบอลเพศชาย 15 คน ด้วยการสัมภาษณ์กึ่งโครงสร้างร่วมกับการทบทวนเอกสารและงานวิจัยที่เกี่ยวข้อง นำข้อมูลมาวิเคราะห์และสังเคราะห์เพื่อออกแบบโปรแกรมการฝึกเอส เอ คิวร่วมกับโปรแกรมฝึกความอ่อนตัวให้สอดคล้องกับความต้องการของเกมการแข่งขันจริง ระยะที่ 2 เป็นการวิจัยเชิงกึ่งทดลอง กลุ่มตัวอย่างเป็นนักกีฬาฟุตบอลเพศชายระดับมหาวิทยาลัย จำนวน 30 คน แบ่งเป็นกลุ่มควบคุม 15 คน และกลุ่มทดลอง 15 คน กลุ่มควบคุมได้รับการฝึกซ้อมตามโปรแกรมปกติของทีม ขณะที่กลุ่มทดลองได้รับโปรแกรมการฝึกเอส เอ คิวร่วมกับโปรแกรมฝึกความอ่อนตัว เป็นเวลา 8 สัปดาห์ ทำการทดสอบความเร็ววิ่งระยะ 30 เมตร และความคล่องแคล่วว่องไวด้วยแบบทดสอบ Illinois Agility Test โดยเวลาเฉลี่ยจากทดสอบ 3 ครั้งของแต่ละแบบทดสอบ ในก่อนการฝึก หลังการฝึก 4 สัปดาห์ และหลังการฝึก 8 สัปดาห์ วิเคราะห์ข้อมูลด้วยค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน และทดสอบความแตกต่างโดยการทดสอบค่า t กำหนดระดับนัยสำคัญทางสถิติที่ระดับ .05 ผลการวิจัยพบว่า ระยะที่ 1 นักฟุตบอลยังมีข้อจำกัดด้านความเร็ว การเปลี่ยนทิศทาง ความอ่อนตัว และการควบคุมร่างกายในการเล่นจริง ซึ่งผลดังกล่าวได้นำมาใช้เป็นข้อมูลพื้นฐานในการออกแบบโปรแกรมการฝึกเอส เอ คิว ร่วมกับโปรแกรมฝึกความอ่อนตัว ในระยะที่ 2 หลังการทดลอง 4 สัปดาห์ กลุ่มทดลองมีผลการทดสอบเวลา Illinois Agility Test ดีกว่ากลุ่มควบคุมอย่างมีนัยสำคัญ และหลังการทดลอง 8 สัปดาห์ กลุ่มทดลองมีผลการทดสอบดีกว่ากลุ่มควบคุมทั้งในตัวแปร 30-Meter Sprint และ Illinois Agility Test อย่างมีนัยสำคัญทางสถิติที่ระดับ .05 แสดงให้เห็นว่าโปรแกรมการฝึกเอส เอ คิวร่วมกับโปรแกรมฝึกความอ่อนตัวที่พัฒนาขึ้นสามารถช่วยเพิ่มความเร็วและความคล่องแคล่วว่องไวของนักกีฬาฟุตบอลชายระดับมหาวิทยาลัยได้อย่างมีประสิทธิภาพ และเป็นแนวทางหนึ่งที่ผู้ฝึกสอนสามารถนำไปประยุกต์ใช้ในการเตรียมสมรรถภาพให้สอดคล้องกับความต้องการของการแข่งขันฟุตบอล

คำสำคัญ: โปรแกรมเอส เอ คิว, โปรแกรมฝึกความอ่อนตัว, ความเร็ว, ความคล่องแคล่วว่องไว, นักกีฬาฟุตบอล

Abstract

This study aimed to develop a Speed, Agility and Quickness (SAQ) training program combined with a flexibility training program, and to examine their effects on speed and agility in football players. A research and development (R&D) design was employed and divided into two phases. Phase 1 was a descriptive and field-based exploratory study where data were collected from five football coaches and fifteen male football players through semi-structured interviews along with a review of relevant documents and research. The information obtained was analyzed and synthesized to design an SAQ plus flexibility training program that corresponded to the demands of actual football competition. Phase 2 used a quasi-experimental research design. The sample consisted of 30 male university football players, divided into a control group (n = 15) and an experimental group (n = 15). The control group followed the team's regular training program, whereas the experimental group received the SAQ plus flexibility training program for 8 weeks. Speed was assessed using a 30-meter sprint test, and agility was assessed using the Illinois Agility Test, recording the mean time of three trials for each test at pre-training, after 4 weeks of training, and after 8 weeks of training. Data were analyzed using mean and standard deviation, and differences were tested using the independent t-test with the level of statistical significance set at .05.

The results showed that, in Phase 1, players exhibited limitations in speed, change-of-direction ability, flexibility, and body control during actual match play. These findings were used as baseline information for designing the SAQ plus flexibility training program in Phase 2. After 4 weeks of intervention in phase 2, the experimental group achieved significantly better Illinois Agility Test times than the control group. After 8 weeks, the experimental group also outperformed the control group on both the 30-meter sprint and the Illinois Agility Test at the .05 level of statistical significance. These findings indicate that the combined SAQ and flexibility training program developed in this study can effectively enhances speed and agility in male university football players and provides a practical guideline for coaches to prepare players' physical fitness for the demands of competitive football.

Keywords: SAQ training, Speed, Agility, Flexibility training, Football players

1. Introduction

Football (soccer) is one of the most popular sports, and in the present era, coaches are continually required to search for and apply diverse training methods to enhance players' performance. Football players need to possess not only well-developed technical skills but also a high level of physical fitness to achieve success in competition. Components of optimal physical fitness for football include muscular strength, power, endurance, speed, balance, neuromuscular coordination, flexibility and, most importantly, agility.

Movement in football can be broadly classified into two types: movement without the ball, which involves repeated acceleration, deceleration, and rapid changes of direction to evade opponents; and movement while in possession of the ball, which requires controlling and manipulating the ball with the

feet. Given these demands, agility, or the ability to change direction quickly, is regarded as a fundamental physical fitness attribute in football, as players must constantly use agile movements to gain an advantage over opponents. Therefore, the development of agility in football players is considered a critical component of performance enhancement (Thachaila, 2018).

In football competitions, players must perform movements without the ball that involve acceleration, deceleration, and changes of direction to evade marking and defensive pressure, create space to receive the ball and move into goal-scoring positions. These actions are sport-specific motor skills and collectively represent agility in football. Therefore, agility forms a crucial foundation of physical fitness in this sport. In any type of sport, if athletes can control their movements efficiently and in accordance with the sequential demands of sport-specific motor skills during competition, it will be beneficial to their performance.

The ability to move and change position rapidly in harmony with the required movement patterns provides athletes with an advantage at every opportunity and every moment of play. Coaches should therefore understand the principles and methods of training to develop agility in ways that align with the specific movement skills and movement demands of each sport, because every sport has its own distinctive movement patterns (Krabuanrat, 2014). Consequently, training programs must be designed in ways that are appropriate for and specific to the skills and demands of each sport.

Speed, agility and quickness (SAQ) training is a widely implemented and well accepted method for developing agility, and consists of drills that specifically target speed, agility and quickness. Hale (2004) noted that most SAQ drills are based on the principle of neuromuscular coordination training, which refers to the ability of the central nervous system and the muscles to work together to perform complex movements efficiently and accurately. Athletes who demonstrate superior neuromuscular coordination can learn new skills more rapidly and perform these skills with a high level of proficiency. Athletes with a high degree of agility gain a clear advantage in many aspects of performance, particularly in changing direction quickly to evade opponents and in dribbling the ball at speed, both of which depend on speed, agility and rapid reaction. When these movement patterns are practiced correctly and to a high degree of mastery, athletes can express their skills effectively in competitive situations. Furthermore, the enhancement of agility in football players also depends on flexibility training, because the changes that occur in tendons and joints during running and changes of direction directly influence the efficiency of movement in football (Andrašić et al., 2021).

Several empirical studies have provided direct evidence that SAQ-based interventions can improve speed- and agility-related performance in football players. Milanović et al. (2013) reported that a 12-week SAQ conditioning program produced significant improvements in multiple field-based agility tests, both with and without the ball, in young male soccer players compared to a control group. Similarly, Lee et al. (2024) showed that eight weeks of SAQ training led to greater gains in acceleration, maximal sprint speed and change-of-direction performance than general football training in highly trained under-20 female football players. At a broader level, a recent meta-analysis by Sun et al. (2025) synthesized nine intervention studies and found that SAQ training produced small-to-moderate improvements in sprint speed, change-of-

direction ability, change-of-direction dribbling and lower-limb power in adolescent soccer players when compared with control conditions. Collectively, these findings support the use of SAQ training as an evidence-based approach for enhancing speed and agility in football, in line with the conceptual rationale outlined above.

In addition, flexibility-oriented interventions have also been shown to contribute to agility performance while lowering injury risk. Behm (2023), in a narrative review on dynamic stretching, reported that incorporating dynamic flexibility exercises into warm-up routines can acutely increase the range of motion. When combined with sport-specific dynamic activities, it is also associated with reductions in musculotendinous injury incidence in sports that require rapid accelerations and frequent changes of direction, such as football.

Given the importance of physical fitness components related to rapid movement and changes of direction, it is evident that these attributes are indispensable in both the training and competitive performance of football players. Numerous investigations have explored the development of agility through various integrated training modalities in different athletic populations and across diverse training formats. Therefore, the present study was designed to develop and evaluate a combined training program that integrates speed, agility, and quickness (SAQ) training with flexibility training, and to examine their effects on speed and agility in football players. This combined protocol is expected to serve as an additional, potentially more effective modality for enhancing the physical fitness of Thai football players, and to provide football coaches with evidence-based guidelines for selecting training methods that are optimally aligned with the goal of maximizing athletes' performance development.

2. Materials and methods

This study was designed to develop a training program that integrates speed, agility, and quickness (SAQ) training with flexibility exercises to improve speed and agility in football players. Additionally, it aimed to experimentally examine and evaluate the effects of this combined SAQ and flexibility training program on the speed and agility of football players in control and experimental groups before training and after 4 and 8 weeks of training. The investigation was conducted in two phases as follows

Phase 1 Field investigation for the development of a combined speed, agility and quickness (SAQ) and flexibility training program to enhance speed and agility in football players.

1. Permission was obtained from the relevant institutional authorities, and the football team coaches to conduct field data collection.

2. The research objectives were explained to the coaches and players, and informed consent was obtained from all participants.

3. The sample for the Phase 1 field study was selected using purposive sampling from individuals involved in university-level football training. The sample consisted of five football coaches, all of whom were responsible for coaching university football teams, had at least two years of experience in training and supervising football players, and were serving as coaches during the current competitive season; and 15

male football players, all of whom were members of the university football team, had participated regularly in team training for at least six months, and had no medical contraindications or severe injuries that would prevent participation in training during the data collection period.

Thus, the total sample in Phase 1 comprised 20 participants. All participants were informed of the research objectives and provided consent prior to data collection. Phase 1 took the form of a descriptive survey-based investigation of the current situation and needs of relevant stakeholders, to generate baseline information for the development of the training program. The sample size was therefore determined based on contextual appropriateness within the population of university football coaches and players.

4. Semi-structured interviews were conducted individually with each football coach, focusing on questions related to current problems and constraints in physical fitness training. Audio recordings and field notes were used to document the interviews, including the coaches' perspectives on integrating SAQ drills and flexibility training within a combined training program.

5. Data obtained from questionnaires, interviews, and observations were analyzed and synthesized in conjunction with a review of relevant literature and research. This process was used to develop a combined SAQ, and flexibility training program aimed at improving speed and agility in football players.

6. The combined SAQ and flexibility training program to improve speed and agility in football players was tried out with football players who were not part of the study sample, and the combined SAQ and flexibility training program was then revised to be appropriate for developing a training program model to improve speed and agility in football players. The research instruments used in the study were also constructed and tested for quality.

The procedures for constructing the instruments were as follows:

6.1 Relevant documents, books, textbooks, and research studies concerning the development of a combined SAQ and flexibility training program were reviewed.

6.2 A combined SAQ and flexibility training program to improve speed and agility for football players was developed.

6.3 The program developed by the researcher was discussed with the co-researchers to check its accuracy.

6.4 The developed program was submitted to three experts to examine content validity. The experts evaluated the consistency of each drill with the intended construction and assigned scores. The index of item–objective congruence (IOC) was then calculated, and only training drills and tests with an IOC value of .50 or higher were retained for use in training and testing.

6.5 The researcher revised the speed and agility training program based on the experts' suggestions.

7. The revised speed and agility training program, which integrated five SAQ-based agility exercises (running in T- and Y-shaped patterns and short multi-directional movements followed by 10-metre straight and lateral sprints) with a 16-exercise flexibility routine targeting the major muscle groups of the lower limbs, hips, trunk and shoulders, was then implemented with the sample in Phase 2 of the study. The program was designed in accordance with the principles of training specificity, progressive overload and

neuromuscular coordination, with the aim of improving short-distance sprint speed, change-of-direction ability and functional range of motion while reducing muscle tightness and injury risk.

Phase 2 Experimental implementation and evaluation of the combined SAQ and flexibility training program on the speed and agility of football players in the control and experimental groups before training and after 4 and 8 weeks of training. In this phase, the program was applied in actual training sessions with the sample, as detailed below.

1. Permission was obtained from the relevant institutional authorities, and the football team coaches to collect data on the implementation of the combined speed, agility, and quickness (SAQ) and flexibility training program.

2. The research objectives were explained to the coaches and athletes, and informed consent was obtained from all participants.

3. The sample consisted of 30 male football players from the Naresuan University football team, selected by purposive sampling from the entire population. The sample size was determined according to the general guideline that, for experimental research, at least 15 participants per group are required (McMillan & Schumacher, 2014). This is consistent with statistical criteria for comparing mean differences between two groups, with an effect size (ES) of 0.95 and a Type I error (level of statistical significance) of α = .05. Using the G*Power program (Version 3.1), the minimum required sample size was thus 15 participants per group. Subsequently, purposively selected volunteers who were in good health and able to participate throughout the training program were recruited. They underwent testing before training, during training at week 4, and after training at week 8. Participants in both groups were assessed for speed using a 30-metre sprint test with timing (Taşkın, 2008), and for agility using the Illinois Agility Test (Hachana et al., 2013). Inclusion criteria were applied prior to participation in the training program. All 30 eligible participants were then randomly assigned by drawing lots into two groups: an experimental group (n = 15) and a control group (n = 15). All participants met the inclusion and exclusion criteria described below.

Inclusion criteria were as follows:

1. Participants were required to volunteer to take part in the study and to provide written informed consent from their parents or legal guardians.

2. Participants were required to have no chronic diseases or medical conditions that would interfere with participation in the study.

3. Participants agreed and acknowledged that they might take part in other football skill training programs in addition to the training program implemented in this research project.

4. Participants were male football players who had been selected by their coaches as members of the Naresuan University representative team, were in good health, and were between 18 and 23 years of age in the 2023 academic year at Naresuan University, Phitsanulok Province, with a total of 30 players.

Exclusion criteria were as follows

1. Participants who developed health problems or sustained injuries that, in the judgment of the researcher, posed a risk to the participant or constituted an obstacle to the conduct of the study.

2. Participants who engaged in additional football skill training beyond the training program

prescribed in this research program.

3. Participants whose attendance at the training sessions was less than 80% of the total duration of the research program.

4. The intervention was implemented by assigning different types of training according to the research groups, as follows:

4.1 Training for the control group consisted of the regular training program used weekly by the male football team coach at Naresuan University, Phitsanulok. This routine included warm-up and stretching, football skill training such as passing and receiving, dribbling and shooting, as well as tactical play such as defensive and offensive organization, followed by a cool-down using stretching exercises.

4.2 Training for the experimental group consisted of the regular coach-led team training program supplemented, within the same training sessions, by the SAQ and flexibility training components. In each session, players first completed the coach-prescribed warm-up, followed by the SAQ exercises, and then performed the 16-exercise flexibility routine as part of the cool-down, as detailed below.

4.2.1 SAQ Training

The training program was implemented over a period of 8 weeks. In weeks 1–2, training was conducted twice per week; in weeks 3–4, three times per week; in weeks 5–6, four times per week; and in weeks 7–8, five times per week, following a progressive overload principle. All training drills were performed at maximal effort, with a 1-minute rest interval between sets. The program comprised five training drills as follows

Exercise 1: running in a T-shaped pattern.

Exercise 2: running in a Y-shaped pattern.

Exercise 3: alternating changes of direction followed by a 10-metre sprint.

Exercise 4: straight-line running with alternating leg movements followed by a 10-metre sprint.

Exercise 5: lateral running with alternating leg movements followed by a 10-metre sprint.

Each exercise was performed for three sets, in addition to the regular futsal training, which was identical to that of the control group and was prescribed daily by the Naresuan University football team coach in Phitsanulok.

4.2.2 Flexibility Training

The flexibility training program was implemented as a static stretching protocol over 8 weeks, with training conducted twice per week in weeks 1 and 2, three times per week in weeks 3 and 4, four times per week in weeks 5 and 6, and five times per week in weeks 7 and 8. The stretching component consisted of 16 muscle-stretching exercises, each performed for two repetitions of 10–15 seconds, organized according to the following muscle groups.

4.2.2.1 Shoulder and posterior upper arm stretching

4.2.2.2 Thigh muscle stretching

4.2.2.3 Hip muscle stretching

4.2.2.4 Thigh muscle stretching

4.2.2.5 Posterior upper arm and posterior shoulder stretching

4.2.2.6 Trunk muscle stretching

4.2.2.7 Posterior shoulder and shoulder-rotator muscle stretching

This was carried out in addition to the regular football training, which was identical to that of the control group and was prescribed daily by the Naresuan University football team coach in Phitsanulok. Before the training period, at week 4 during the training, and after week 8 of the training program, participants in both groups were assessed for speed using a timed 30-m sprint and for agility using the Illinois Agility Test. The data obtained from these assessments were then analyzed.

5. Analysis of the experimental outcomes and evaluation of the effects of the combined SAQ and flexibility training program on speed and agility in football players in the control and experimental groups before training and after weeks 4 and 8 of the training programs.

3. Result

3.1 Qualitative findings on current problems and constraints in physical fitness training from the perspectives of coaches and athletes.

3.1.1 Coaches

From the interviews with all five football coaches, several common themes emerged regarding problems and limitations in players' physical fitness during competition, which directly affect their ability to execute the team's game plan, as follows

3.1.1.1 Speed and change of direction abilities did not match the tempo of actual match play. Several coaches reported that players accelerated and changed direction more slowly than required by the tactical game plan, which resulted in the loss of crucial moments both in attack, such as fast counterattacks, and in defense, such as closing space or shifting the defensive line. Consequently, opponents were able to penetrate dangerous areas more easily.

3.1.1.2 The capacity for continuous movement declined toward the end of the match. Fatigue in the second half was identified as a common problem, leading to slower movement, reduced responsiveness to game situations, and a marked decrease in the planned intensity of play. As a result, the team lost compactness and overall tactical effectiveness.

3.1.1.3 The existing training formats were not aligned with real match situations. Coaches agreed that training which emphasized long-distance running or laps around the field did not adequately develop short, intensive movements that require stopping, accelerating, turning, and changing direction, which are key movement behaviors in football. This mismatch limited the practical application of tactics that depend on speed and complex movement patterns.

3.1.1.4 Limitations in flexibility and body control affected both injury risk and movement quality. Some coaches observed that many players had high levels of muscle tightness and an incomplete range of motion, which negatively influenced agility and dribbling in attacking play and increased the risk of injury, particularly during rapid acceleration or sharp changes of direction.

3.1.1.5 There was a lack of a clearly structured training program and no systematic monitoring of outcomes. Coaches indicated that current fitness training lacked an organized framework and regular assessment of progress, making it impossible to determine whether training truly improved physical fitness. This led to inconsistent quality of performance, especially in high pressure situations.

3.1.2 Football players

Based on in-depth interviews with all 15 football players, the primary factors constraining their ability to implement the match plan were found to be directly associated with several components of physical fitness, including speed, acceleration, change of direction, flexibility, endurance, and body control.

3.1.2.1 Speed and acceleration that do not match the tempo of play. Many players reported feeling that their initial acceleration was slow or that they could not increase their speed quickly enough to keep up with teammates, resulting in missed positions in counterattacking situations or during transitions from defense to attack, and consequently disrupting the team's offensive rhythm.

3.1.2.2 Insufficient agility in changing direction and turning. A substantial number of players experienced difficulties under pressure or in confined spaces, reporting that they were unable to turn quickly enough, were easily dispossessed, and frequently lost the ball. One-on-one situations and high-speed dribbling were also perceived as less effective due to suboptimal body control.

3.1.2.3 Inability to keep pace with offensive–defensive transitions. Many players reported that they were "unable to move up and down the pitch in time" or "could not transition from attack to defense quickly enough," which resulted in loss of defensive positioning or incomplete support in attack. Although they understood the tactical requirements, their physical responses were not fast enough to meet the demands of the game.

3.1.2.4 End-of-match fatigue affecting tactical execution. Several players indicated that their speed and agility decreased markedly toward the end of the match. This decline led to a loss of compactness in defense and an inability to execute attacking movements in accordance with the patterns prescribed by the coach.

3.1.2.5 Insufficient flexibility and accumulated muscle tightness. Some players reported tightness in the hamstrings and hip muscles, which limited their ability to turn, change direction while running, and accelerate through the full range of motion. This not only reduced performance effectiveness in actual match play but also increased the risk of injury.

3.1.2.6 Suboptimal short-distance speed and situational responsiveness. Many players noted that they frequently lost timing on second balls or challenges because they initiated movement too slowly and were unable to respond quickly enough to opponent's movements.

3.2 Experimental results and evaluation of the effects of the combined SAQ and flexibility training program on the speed and agility of football players in the control and experimental groups before training and after 4 and 8 weeks of training in this study.

3.2.1 The participants in the control group had a mean height of 172.93 ± 6.76 kilograms, a mean body weight of 61.60 ± 6.90 centimeters, and a mean body mass index of 20.57 ± 1.71 kg/m². Their mean heart rate was 68.60 ± 6.96 beats per minute, with a mean systolic blood pressure of 124.47 ± 7.41 mmHg and a mean diastolic blood pressure of 78.80 ± 7.02 mmHg. In the experimental group, the mean height was 174.13 ± 5.57 kilograms, the mean body weight was 64.67 ± 7.50 centimeters, and the mean body mass index was 21.27 ± 1.56 kg/m². The mean heart rate in this group was 67.53 ± 6.30 beats per minute, with a mean systolic blood pressure of 121.20 ± 7.99 mmHg and a mean diastolic blood pressure of 73.53 ± 7.98 mmHg in Table 1.

Table 1. The mean and standard deviation of the participants' baseline characteristics in the study.

Participant Characteristics	Control Group (n = 15)		Experimental Group (n = 15)	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Height (cm.)	172.93	6.76	174.13	5.57
Weight (kg.)	61.60	6.90	64.67	7.50
Body mass index (kg/m^2)	20.57	1.71	21.27	1.56
Pulse (Time/min^{-1})	68.60	6.96	67.53	6.30
Systolic blood pressure (mmHg)	124.47	7.41	121.20	7.99
Diastolic blood pressure (mmHg)	78.80	7.02	73.53	7.98

3.2.2 The 30-metre sprint and Illinois Agility Test data were examined for normality. In both the control and experimental groups, the distributions did not significantly deviate from a normal distribution at the .05 level (Table 2). As the assumption of normality was satisfied, differences between the experimental and control groups were analyzed using independent t-tests. At baseline, no statistically significant differences were found between the groups in mean 30-metre sprint time or agility scores ($p > .05$). After 4 weeks of training, the experimental group demonstrated significantly better Illinois Agility Test scores than the control group ($t = 3.431$, $p = .002$). After 8 weeks, significant between-group differences were observed in both the 30-metre sprint ($t = -4.455$, $p < .001$) and the Illinois Agility Test ($t = 1.344$, $p < .01$) (Table 3).

Table 2. The results of the normality analysis (Normal distribution) of speed and agility data using the Shapiro–Wilk test for the control and experimental groups (n = 30)

List of tests	Test of normality (Shapiro-Wilk)			normality of the data
	Statistic	df	Sig.	
Control Group (n = 15)				
Pre-test				
30-Meters Sprint	.908	15	.127	Normal
Illinois Agility Test	.983	15	.986	Normal
Mid-test (After 4 weeks)				
30-Meters Sprint	.897	15	.087	Normal
Illinois Agility Test	.985	15	.992	Normal
Post-test (After 8 weeks)				
30-Meters Sprint	.909	15	.132	Normal
Illinois Agility Test	.985	15	.994	Normal
Experimental Group (n = 15)				
Pre-test				
30-Meters Sprint	.908	15	.128	Normal
Illinois Agility Test	.963	15	.737	Normal
Mid-test (After 4 weeks)				
30-Meters Sprint	.901	15	.097	Normal
Illinois Agility Test	.952	15	.551	Normal
Post-test (After 8 weeks)				
30-Meters Sprint	.912	15	.148	Normal
Illinois Agility Test	.922	15	.203	Normal

**P-value* < .05

Table 3. The results of the analysis of differences in speed and agility among football players between the two groups using the independent t-test.

List of tests	Control Group (n = 15)		Experimental Group (n = 15)		t	Sig.
	$\bar{X}$	S.D.	$\bar{X}$	S.D.		
Pre-test						
30-Meters Sprint	4.43	0.22	4.43	0.22	.016	.987
Illinois Agility Test	16.72	0.55	16.54	0.75	.735	.468
Mid-test (After 4 weeks)						
30-Meters Sprint	4.41	0.21	4.39	0.21	.250	.805
Illinois Agility Test	16.70	0.55	15.95	0.63	3.431	.002*
Post-test (After 8 weeks)						
30-Meters Sprint	4.38	0.21	4.13	0.06	4.445	<.001*
Illinois Agility Test	16.66	0.54	15.74	0.63	1.344	<.001*

**p-value* <.05

4. Discussion

4.1 Discussion of the qualitative analysis of current problems and limitations in physical fitness training from the perspectives of coaches and football players, as follows:

4.1.1 The synthesis of the coaches' accounts. It emerged that the main problems related to players' physical fitness were directly linked to actual match performance. Many players were unable to accelerate and change direction in line with the tempo of the game, which resulted in lost opportunities both in fast counterattacking situations and in defensive moments when closing space. Consequently, opponents were able to penetrate dangerous areas more easily. In addition, toward the end of matches, players commonly experienced fatigue, moved more slowly, and responded less effectively to changing situations. The overall intensity of play declined, making it difficult for the team to maintain its tactical structure and compactness. Moreover, the coaches also indicated that the current training formats largely emphasized long-distance running or laps around the field, which do not correspond to the actual movement demands of football, where players must frequently stop, accelerate, turn, and change direction rapidly over short distances. Some players were reported to have pronounced muscle tightness and limited range of motion, which reduced their agility in dribbling and evasive movements and increased their risk of injury, particularly during high-speed accelerations or sharp changes of direction. Furthermore, the coaches noted that fitness training lacked a clearly structured program and systematic monitoring. As a result, it was difficult to determine the extent to which the existing training improved players' physical fitness and prepared them to cope with high-pressure match situations.

4.1.2 The synthesis of the football players' accounts indicated that key deficiencies in physical fitness exerted a clear influence on on-field performance. Many players reported that they were slow off the mark and unable to accelerate quickly enough to keep pace with teammates, resulting in failure to reach the positions required for counterattacks or for rapid transitions from defense to attack. Although they understood where they were supposed to run according to the tactical plan, their bodies could not respond quickly enough. When confronted with opponents pressing aggressively or when play became fast in restricted spaces, they often could not turn in time, were easily forced into losing possession, and were unable to perform high-speed dribbling or one-on-one situations effectively due to insufficient body control. In addition, many players noted a marked decline in speed and agility toward the end of matches. This reduction led to a looser defensive shape, less effective space coverage, and attacking movements that could not be executed in accordance with the patterns prescribed by the coach. Some reported pronounced muscle tightness, particularly in the hamstrings and hip region, which limited their ability to turn, change direction while running, and accelerate to full speed, thereby increasing the risk of injury. In second-ball situations or challenges for possession, they frequently reacted more slowly than their opponents because they initiated movement late and were unable to respond promptly to opponents' movements. Overall, these findings indicate that the players' speed, agility, flexibility, and situational responsiveness were not yet sufficient to fully support the tactical demands required in competitive play.

Based on the accounts of both coaches and players, the physical fitness of the athletes did not adequately meet the demands of competitive match play, particularly in terms of speed, acceleration, change of direction, and body control. Therefore, players were often unable to respond to the tempo of the game in accordance with the tactical plan, whether in situations involving counterattacks, closing down space, or transitioning from attack to defense. In addition, players experienced pronounced fatigue toward the end of matches, which led to a decline in movement efficiency and an inability to maintain the intended tactical intensity. Many players also reported tightness in the hamstrings and hip muscles, resulting in a reduced range of motion and increased injury risk, especially during high-speed acceleration or abrupt changes of direction.

At the same time, the existing training formats were not well aligned with the movement demands of modern football, which requires frequent stopping, accelerating, turning and changing direction over short distances; instead, training predominantly emphasized long-distance running or laps around the pitch. Moreover, the lack of a clearly structured program and an associated monitoring system made it difficult to evaluate progress consistently. Collectively, these observations indicate that players require targeted development of specific fitness components to execute tactical game plans effectively under real match conditions. This is consistent with Gonçalves et al. (2021), who examined the relationship between physical fitness levels and running performance during competition in adult female football players using a cohort study design. Their findings showed that physical fitness indicators such as repeated-sprint ability, aerobic endurance and muscular power were associated with high-speed running distance and sprinting during actual matches, with better-conditioned players able to sustain high-speed running and respond more effectively to game tempo. This accords with the present findings, which suggest that insufficient speed and

change-of-direction capacity limit players' ability to perform tactically as intended. Similarly, Hosseini et al. (2025) investigated the effects of an 8-week dynamic hamstring stretching program, specifically Nordic hamstring training, on balance, range of motion, agility and muscle performance in male football players with short hamstrings, using a randomized controlled trial design. Their results demonstrated that a structured 8-week stretching and strengthening program for the hamstrings significantly improved range of motion, balance, agility and muscle performance in players with hamstring tightness. These findings are in line with the present study's conclusion that tightness in the hamstrings and hip muscles restricts the range of motion, increases injury risk, and negatively affects sprint performance and change of direction during actual match play.

4.2 Discussion of the differences in speed and agility between the experimental and control groups, and within groups across pre-test, 4-week post-test, and 8-week post-test measurements.

After 4 weeks of training, the experimental group showed better Illinois Agility Test times than the control group, and after 8 weeks the experimental group outperformed the control group in both the 30-metre sprint and the Illinois Agility Test, with differences that were statistically significant at the .05 level. These improvements can be attributed to the training program, which emphasized short-distance movements, stopping, accelerating and changing direction, combined with exercises to enhance muscle and joint flexibility. Such training enabled players to respond more effectively to game tempo, move more rapidly, and control their movement direction on the pitch more efficiently.

Physiologically, the changes observed as early as the first 4 weeks are likely related to neural adaptations, whereby the brain and nervous system become more familiar with the required movement patterns, allowing muscles to be activated more rapidly and in better coordination. Concurrent flexibility training reduced muscle tightness, particularly in the hip and hamstring regions, thereby facilitating smoother strides, turning and changes of direction without restriction. With continued training over the full 8-week period, these adaptations translated into clearer gains in both sprint speed and overall agility. These findings are consistent with Hosseini et al. (2025), who reported that an 8-week program of hamstring stretching and strengthening produced significant improvements in range of motion, balance and agility among football players. In line with their results, the present study indicates that a flexibility-oriented program combined with high-velocity movement and change-of-direction training has a positive effect on athletes' physical performance.

When the training was completed at 8 weeks, the experimental group showed clear improvements in both short-distance speed over 30 meters and agility. This finding is consistent with the principle that when training stimuli are sufficiently specific and continuous, adaptive changes occur in both the neuromuscular system and the muscle–tendon mechanism. As a result, the rate of force development improves, and the muscle–tendon stretch–shortening cycle operates more efficiently during sprinting and changes of direction, thereby reducing the time required for short accelerations and directional changes. These results are in line with the study by Gołaś et al. (2024), which examined the effects of an 8-week pre-season specialized training program on sprint performance, agility, and lower-limb muscle imbalance in

professional football players. Their 8-week position- and task-specific program, designed to closely replicate football movement patterns, produced significant improvements in short sprint speed (5 m and 30 m) and change-of-direction ability, as well as reductions in lower-limb muscle imbalance. Taken together, these findings indicate that a well-designed and football-specific training program can effectively enhance speed and agility and better support the physical demands of competitive match play.

In terms of flexibility, the findings of this study indicate that flexibility training combined with high-velocity movement contributes to improvements in both sprint speed and change-of-direction ability. This is consistent with Bogalho et al. (2022), who reported that greater flexibility of the hip and knee musculature particularly the hamstrings is significantly associated with better short-distance sprint performance over 5, 10 and 20 meters. They concluded that hamstring flexibility is a key component underpinning football-specific skills such as jumping, sprinting, and high-agility movements. Thus, training programs that simultaneously target flexibility and body control play an important role in reducing muscular tightness in the hip and thigh region, lowering the risk of injury, and enhancing the efficiency of acceleration and directional changes during competitive match play.

5. Conclusion and suggestions

5.1 Conclusion

The present study developed a combined speed, agility, and quickness (SAQ) training program together with a flexibility training program. Field data obtained from coaches and football players indicated that athletes' speed and agility were still not fully aligned with the demands of actual competition, particularly in terms of initial acceleration, change of direction, and maintaining high playing intensity throughout the match. When this program was implemented with male university football players over 8 weeks, the results showed that after 4 weeks of training the experimental group achieved significantly better Illinois Agility Test scores than the control group. After 8 weeks, the experimental group also outperformed the control group on both the 30 meters sprint and the Illinois Agility Test at the .05 level of statistical significance. These findings demonstrate that the SAQ training program combined with flexibility exercises developed in this study can effectively enhance speed and agility in football players.

The weekly training frequency was intentionally increased from two to five sessions across the 8-week period in accordance with the principles of progressive overload and progression. Therefore, the differences observed between the 4-week, and 8-week assessments reflect both the longer exposure time and the higher accumulated training load, which is consistent with real-world periodized conditioning practice rather than a fixed-dose laboratory protocol.

5.2 Suggestion

5.2.1 University and club-level football coaches should consider incorporating the combined SAQ and flexibility training program into their regular weekly training routines, particularly during the pre-season and throughout the competitive season. This approach can help develop players' speed

and agility in line with the specific demands of match play, while also reducing problems related to muscle tightness and lowering the risk of injuries arising from rapid sprinting and sudden changes of direction.

5.2.2 Future research should involve a more diverse sample in terms of sex, playing level, and type of sport, and should also examine the effects of the program on match-derived performance indicators, such as the number of high-speed runs or statistics related to involvement in offensive and defensive actions. Such evidence would provide more comprehensive information for designing training programs that are optimally suited to the specific contexts and needs of different teams.

6. Human Research Ethics Approval

The research project entitled “Development of a Speed, Agility and Quickness (SAQ) Training Program Combined with Flexibility Training on Speed and Agility in Football Players” was approved in accordance with international ethical standards for research involving human participants, including the Declaration of Helsinki, the Belmont Report, the CIOMS Guidelines, and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP) (IRB No. P1-0177/2567).

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