

EFFECTS OF THE FIFA 11+ AND HARMOKNEE WARM-UP PROGRAMS ON PHYSICAL PERFORMANCE MEASURES IN INDIAN ELITE FOOTBALL PLAYERS (AN EXPERIMENTAL STUDY)

Sayyad A¹, Kahile M¹, Deshmukh N^{1*}, Guhe A¹, Chandi D², Bhojar K³

1. Department Of sports medicine and Physiotherapy, Datta Meghe College of physiotherapy, Wardha, Maharashtra, India
2. Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India
3. Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India

ABSTRACT

This study was carried to determine the benefits of fifa 11+ and harmoknee warm-up protocol in indian male football players and conclude the superiority between the two established protocols in accordance with their effects on sprinting, vertical jump, kicking accuracy, and agility. 45 healthy male footballers (mean age 21.44±5.3yrs, height 1.76±0.2m & weight 73.19±11.5kgs) participated in the study. The participants were equally divided into group a= fifa 11+, group b = harmoknee, and the control group. The experimental groups (gp a & gp b) underwent training for 6 weeks, and trained for 20 minutes per session on all days except sunday (36 sessions), whereas the control group performed their regular football training. The performance tests carried out were the 20m speed test, vertical jump test, illinois agility test, and wall volley test. The results were analyzed by spss version 17. Within-group pre and post comparisons were done using paired t-test, an inter-group comparison was done using one-way anova followed by multiple comparisons bonferroni. The level of significance for all tests was set at 5% (p=0.05). In the present study, the vertical jump was improved significantly only in gp a (6.75% increase, p=0.001) as compared to gp b (p=0.082) & the control group (p=0.291). While agility improved in both gp.a (7.23% increase, p=0.00) & gp.b (5.43% increase, p=0.001), no significant improvements were observed in the kicking accuracy & sprinting ability in all the 3 groups within group comparison. However, on inter-group comparison, significant differences were observed between group a & b (p=0.009) with gp b demonstrating more kicking accuracy as compared to gp a. 6-weeks training of 11+ warm-up program enhance vertical jump and agility but it does not improve player's kicking accuracy and sprinting ability and the harmoknee program improves agility but has no positive effect on sprinting and kicking accuracy in young professional male footballers. 11+ injury prevention programs can be implemented to enhance agility and vertical jump in young male football players.

KEYWORDS: Performance, Vertical jump test, Wall volley test.

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CORRESPONDENCE:

Deshmukh N* ✉ nehadeshmukh57@gmail.com

Address – Assistant Professor, Department Of Musculo skeletal Physiotherapy, Datta Meghe College of physiotherapy.

INTRODUCTION

Football is the most popular team sport in the world there are already more than 265 million registered players. According to the International Federation of Association Football (FIFA), 90% of all the registered players were males, with younger football players comprising the greatest proportion (54.7%) of all registered male players. It is a contact sport and challenges physical fitness by requiring a variety of skills at different intensities. Running is the predominant activity, and explosive efforts during sprints, duels, jumps, and kicks are important performance factors. To strengthen the possibility of their success in the sport, football players need a moderate to a high degree of aerobic and anaerobic strength, strong endurance, and a range of technical and tactical skills.⁽¹⁾

The Warm-up is considered a vital element and is used by athletes on a daily basis to prevent injury and maintain high performance during training and competition. The warm-up, better known as “warming”, aims to prepare the competitor,

Both physical and mentally, taking their muscles to the point where the work occurs more efficiently. Globally the two most widely used football-specific warm-up programs are the 11+ and Harmoknee programs. The FIFA Medical and Research Centre (FMARC) developed the 11+ warm-up program for football players. The 11+ program is an advanced version of the 11 programs, includes running, strength, plyometric and balance components.^(1,2)

The HarmoKnee warm-up program for football players. It includes five parts the essentially consist of a warm-up and muscle activation, along with balance, strength, and core stability exercises. The results showed that the intervention group was associated with a 77% decrease in knee injuries. Furthermore, it is shown that the most effective way to prevent injuries in young football players is to have a proper warm-up program.^(1,2)

Need for study

Recently, studies reported positive effects of the 11+ and Harmoknee programs on balance and proprioception risk factors and the influence of the 11+ on the improvement of static and dynamic balance on football players. Another investigation using the 11+ programs showed that female football players with high adherence in the supervised 11+ group had 57% lower injury risk compared to the players with low adherence. Several studies have successfully incorporated one or more exercise components, including plyometric, balance, proprioceptive, strength, running, and cutting movement patterns, to prevent injuries in female football players but unfortunately only a few are related to male football players. Ironically, 90% of registered players are men and also the greater number of football players are young football players, who constitute 54.7% of all registered male players.^(1,2) The value of a dynamic warm-up to improve the reactive intensity and jumping ability in football has been established by contemporary studies. However, an efficient warm-up should not only be seen as critical for results, but also as a mechanism for reducing the incidence of injury among players. Compliance with specific dynamic warm-up protocols, such as the FIFA 11+, has been shown to decrease injury risk amongst youth football players.^(1,3)

Only a small number of studies have focused on the 11+ and Harmoknee. There are many findings that have led FIFA to create the 11+ curriculum that involves an improvement in strength and components of exercise to potentially enhance the physical health of football players.^(1,2)

Whether the 11+ and Harmoknee warm-up programs will boost the physical performance of professional football players is uncertain. Further study into the effects on the physical performances of football players of this advanced variant of the 11+ and Harmoknee is also desirable. The present research was therefore intended to examine the impact on the output of young professional male football players of the two commonly used warm-up programs.^(1,2,3)

Method

In the present research, an experimental study was performed on 45 fits, young (n=45) male professional football players (aged between 18 and 25 years) who regularly engaged in football training sessions and whose medical history was devoid of significant lower limb injury or disease. There were three professional teams chosen. The outfield players and the members of one of the three professional teams were all participants. During the 2014 competitive season, all of these players were regular on practice for the past year and participated in official league championships. All the subjects participated in common training consisting of technical and tactical drills such as passing, shooting, dribbling, and heading drills. The experimental study protocol and potential risk of the study were explained to each subject both verbally and written consent was obtained from the players. Approval from the institutional ethical committee (IEC) was obtained.⁽¹⁻³⁾

Procedure

The coaches and team managers from the three professional teams were invited to an instruction course aimed at implementing the intervention programs at the beginning of the data collection. Before the beginning of the intervention programs, all players attended a workshop to learn the proper techniques for executing the exercises. This workshop was performed separately for each team. None of the teams knew about the drills being performed by the other teams. They were presented with video guidance and diagrams on the protocol for the intervention programs and experiments to be carried out during the study.

All the training sessions were supervised by the researcher to ensure they conformed to the standards of compliance and to make certain that the correct technique was used. Verbal encouragements were given throughout the training period to help the subjects concentrate on the quality of their movements. The exercise programs commenced on 18th July 2014 and were completed on 18th September 2014 (36 sessions). The pre-testing was conducted one week prior to the first day of training, while the post-test was recorded three days after the final training session. All tests were conducted in the same order for each player during the pre and post-tests^(1,2,3)

Table 1 shows division of players in three groups FIFA 11+, HarmoKnee and control in that representation of mean age, mean height and mean weight in equally distributed sample of n=15 in each group.

Table 1: Descriptive statistics characteristics of the subjects in the three groups

Groups	FIFA 11+ (n = 15)	HarmoKnee n = 15	Control n=15
Mean Age (years)	22.26	20.93	21.13
Mean Height (m)	1.78	1.72	1.77
Mean Weight (kg)	74.33	72.46	76.66

Experimental protocols of the warm-up programs

Experimental protocol A: The 11+ group

Table 2 Three pieces were the 11+, the first of which included running exercises (part 1). The second section included six exercises, all of which had three difficulty levels and were intended to improve strength, balance, muscle control and core stability (part 2). Advanced running activities were the third and final part of the (part3). The varying levels of complexity increased the quality of the program and encouraged coaches and players to adjust to the program individually. It took around 20-25 minutes to complete the 11 +, which replaced the normal warm-up training. All of the exercises (27 exercises) focused on core stability, neuromuscular function, hamstring strength, and agility. This group performed the 11+ exercises six times per week.^(1,2)

Table 2: Description of the exercises in the structured “11+” warm-up training program

	Exercise Duration
Part 1: Running Straight ahead, hip out, hip in, circling partner, shoulder contact, quick forward & backwards (6 running items, each item 2 sets)	8 minute
Part 2: Strength, plyometric and balance The bench Static, alternate legs and one leg lift and hold (3items, each item 3 sets) Sideways bench- Static, raise & lower hip, with leg lift (3 items, 3 sets on each sides) Hamstring - Beginner (3-5 repetition, 1 set), intermediate (7-10 repetition, 1 set), advanced (12-15 repetition, 1 set). (3 items) Single-leg stance - Hold the ball, throwing ball with partner, test your partner (3 items, each item 2 sets) Squats - With toe raise, walking lunges, one-leg squats (3 items, each item 2 sets) Jumping - Vertical jumps, lateral jumps, box jumps (3 items, each item 2 sets)	10 minutes
Part 3: Running exercise Across the pitch, bounding, plant & cut (3items, each item 2 sets)	

Experimental protocol B: HarmoKnee group

The harmoKnee warm-up program included five parts: warm-up, muscle activation, balance, strength, and core stability, all of which can be combined and performed in a regular football training session (Table 3). The total program duration was 20 to 25 minutes. Similar to the 11+, HarmoKnee was also performed six times per week.^(1,3)

Table 3: Description of the exercises in the structured HarmoKnee warm-up training program

	Exercise Duration
Warm-up - Jogging ($\geq 4-6$ min), Backward jogging on the toes (Approximately 1 min), High-knee skipping (Approximately 30 s), Defensive pressure technique (Approximately 30 s), One and one (≥ 2 min)	≥ 10 min
Activation of the muscles - Activation of calf muscles, muscles of the quadriceps, muscles of the hamstring, muscles of the hip flexor, muscles of the groin, muscles of the hip and lower back (6 items, 4s of each item for each leg/side)	2 min
Balance - Forward and backward double leg jumps, Lateral single leg jumps, Forward and backward single leg jumps, Double leg jump with or without ball (optional), (4 items each item Approximately 30s) Approximately	2 min
Strength - Walking lunges in place, Hamstring curl (in pairs), Single-knee squat with toe raises (3 items each item Approximately 1 min) Approximately	4 min
Core stability - Sit-ups, Plank on elbows and toes, Bridging (3 items each item Approximately 1 min)	3 min

Control group

Throughout the study period, the control group was asked to proceed with their daily training and warm-up sessions. In addition, the control group was told prior to the start of the analysis that they would obtain the intervention program in the subsequent season.⁽⁴⁾

Performance tests

Five standard football-specific tests were performed at the same time of the day under standardized environmental conditions. All the tests were carried out between 8 am and 11 am. A standardized 15-min warm-up, including running, low-intensity cycling and dynamic stretching were performed before the tests. The pre-testing was conducted one week prior to the first day of training, while the post-test was recorded three days after the final training session. All tests were conducted in the same order for each player during the pre and post-test sessions.

20m single sprint

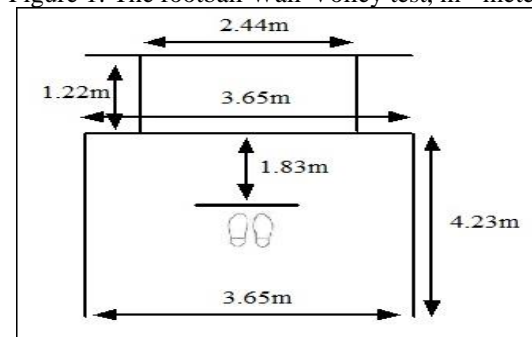
The 20m single sprint is a standard test for assessing football players' running speed. The participants performed two 20m trials, with a 3-min recovery period in between. The players started from a standing position, and the timing system was triggered as soon as they left the starting mat. The best attempt was used for the analysis.^(1,2)

Vertical jump

The vertical jump test has been shown to be a reliable test in measuring the jump performance of football players. Each subject performed two practice jumps prior to testing to ensure proper jumping techniques. They were instructed to jump vertically (initiated from a knee flexion of 90), and execute a maximum vertical jump while swinging their arms actively. Jump height was determined using a measuring tape fastened to a dark paper on which each subject's pretest and post-test jump chalk prints would be clearly recorded. Each subject performed 2 practice jumps and the best score was used.^(1,2,4)

Wall-Volley test

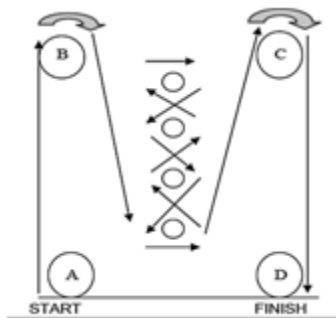
This test is a standard test with high reliability in terms of assessing football players' skill and accuracy in kicking a ball. Players were required to kick a ball from a wall and then trap or kick the ball on the rebound as many times as possible within a 30-sec period, figure 1. The subjects were allowed to kick the ball from the air or ground while avoiding the use of their arms or hands. Each subject performed 3 sets of this test, with the best attempt used for the analysis.^(1,2)

Figure 1: The football Wall-Volley test, m= meter

Illinois agility test

It is commonly used in measuring agility in football. The reliability of this test has been reported to be high (ICC = 0.85). The length of the zone is 10m, while the width (distance between the start and finish points) is 5m. Four cones were placed in the center of the testing area at a distance of 3.3m from one another. Four cones were used to mark the start, finish and two turning points, figure 2. The subjects started the test lying face down, with their hands at shoulder level. The trial started on the “go” command, and the subjects began to run as fast as possible. The trial was completed when the players crossed the finish line without having knocked any cones over. Three trials were performed by every subject with the best score (time) used for analysis.^(4,5)

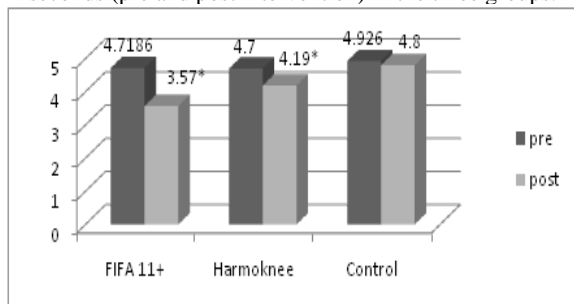
Figure 2: Illinois agility test procedure



RESULTS

In the present study sprinting performance was tested by a 20m single sprint test. On intra-group comparison using T-test significant improvements were observed in FIFA 11+ (t=4.7187, p=0.001) and Harmoknee (t=2.814, p=0.014) groups while non-significant improvement was observed in the control group (t=0.874, p=0.397), with percent improvement in the three groups (24.20, 10.85 and 2.43, respectively), figure 3. On inter-group comparison, using One way ANOVA, significant improvement in running speed was observed only with respect to the control group (p=0.001).

Figure 3: Distribution of the mean values of sprint speed, measured in seconds (pre and post intervention) in the three groups.

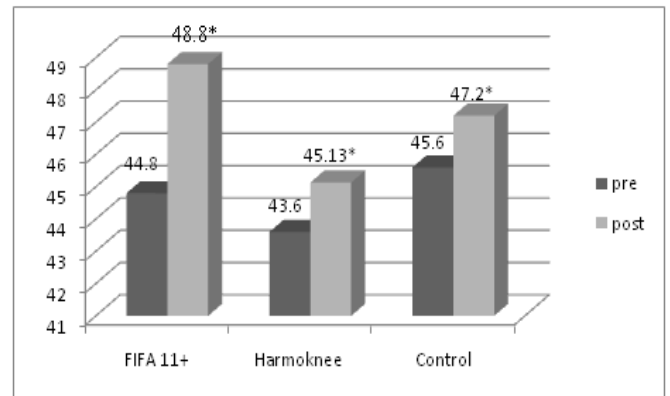


Vertical jump height

In the present study power was tested by vertical jump test. On intra-group comparison using T-test significant improvements were observed in all the three groups i.e. FIFA 11+ (t=-6.321, p=0.001), Harmoknee (t=-2.661, p=0.019) and the control

group (t=-3.617, p=0.003), with percent improvement in the three groups (9.06, 3.50 and 3.37, respectively), figure 4. However, on inter-group comparison, using one-way ANOVA no significant improvement in the vertical jump height was observed in any of the three groups.

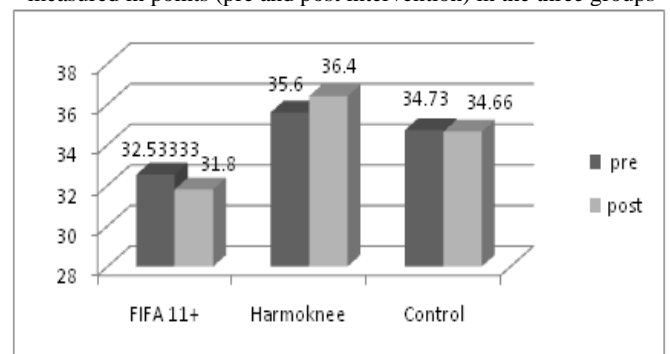
Figure 4: Distribution of the mean values of vertical jump height, measured in centimeter (pre and post intervention) in the three groups



Kicking accuracy

In the present study, kicking accuracy was tested by a wall-volley sprint test. On intra-group comparison using T-test, no improvements in the kicking accuracy were observed in any of the three groups i.e. FIFA 11+ (t=0.582, p=0.570), Harmoknee (t=-1.075, p=0.301) & control group (t=0.091, p=0.929), with percent improvement in the three groups being (2.24, 2.24 and 0.20, respectively), figure 5. However, on the inter-group comparison, using One way ANOVA significant improvement in kicking accuracy was observed between FIFA 11+ and Harmoknee group (p=0.008) only.

Figure 5 Distribution of the mean values of kicking accuracy, measured in points (pre and post intervention) in the three groups

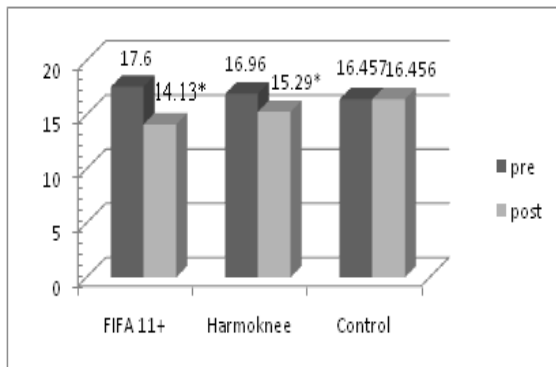


Agility

In the present study agility was tested by the Illinois agility test. On intra-group comparison using T-test, significant improvements in agility were observed in FIFA 11+ (t=11.040, p=0.001), Harmoknee (t=3.673, p=0.003) groups but not in the control group (t=.003, p=0.998), with percent improvement in the three groups being (19.71, 9.84 and 0.24, respectively), figure 6. However, on the inter-group

comparison, using One way ANOVA significant improvement in agility was observed only between FIFA 11+ and Control ($p=0.003$) group.

Figure 6: Distribution of the mean values of agility, measured in seconds (pre and post intervention) in the three groups



DISCUSSION

The aim of this study was to investigate the effect of the 11+ and Harmoknee warm-up programs on the physical performance of elite level young professional male football players.

Running speed was measured by a 20 m single sprint test. The results of our study demonstrated that running speed (tested by) improved in all the three groups; however greatest improvement in the running speed was observed in the FIFA 11+ group, followed by the Harmoknee Group and lastly the control group.^(1,6) who employed the FIFA 11+ program and reported a significant enhancement in 20 m sprints, following 30 sessions (6 weeks) of training, among non-professional male football players, demonstrated that five minutes of nonspecific running, coordination exercises, stretching and acceleration runs (within a warm-up) improved 10m and 30m sprint performance in young male football players, similar to the FIFA 11+ program. Repeated shuttle sprint training of 15-20 m over a 7-week period improved the 30m speed test in adolescent professional male football players.⁽⁷⁾ Moreover, studies showed that plyometric training of forwarding and lateral hopping, shuffle, ladder drills, box and depth jumps.⁽⁸⁾ 40-cm hurdle jumps and 40-cm drop jumps enhanced speed performance in football players.⁽⁹⁾

Vertical Jump Height an indicator of lower extremity power, was measured by Vertical Jump Test. The results of our study demonstrated that vertical jump performance improved in all the three groups with the greatest improvement in the vertical jump height observed in the FIFA 11+ group, followed by the Harmoknee Group and lastly the control group. Similar findings were reported.⁽⁶⁾ The 11 warm-up program for young football players and reported that leg power (3-step jump and countermovement jump) increased significantly by 3.4%. Conflicting results were reported after a ten-week training program using the 11 warm-up programs on female adolescent football players, where no difference in jump height was observed.⁽¹⁰⁾ These differences could be attributed to factors such as the gender and age of the subjects. Although the

findings of are quite similar to those of the present study, the skill levels of the subjects were different. They employed non-professional male football players, whereas professional players were employed in this study.⁽⁴⁾ Based on the magnitude of change in jump performance and comparing the level of the players from the two studies, the 11+ program would seem superior to the 11.^(1,4)

Kicking accuracy was measured by a wall volley test. Our study failed to demonstrate any significant enhancement in kicking accuracy in any of the three groups investigated. A similar study conducted by reported that the addition of small-sided games improves the dribbling performance and kicking efficiency in footballers. Hence, we suggest adding additional training elements such as small-sided games which include three-a-side games, ladder drills, and repeated shuttle sprints in both programs to fully realize the enhancement of kicking accuracy. Many factors amalgamate and influence performance on sport-specific skill tests (which encompasses kicking accuracy as well), including physiological factors (sprint, strength, power), neural control of movement, and perceptual-cognitive skills such as anticipation and visual search strategies.⁽¹¹⁾ Any of these factors, individually or in combination with others may have contributed to the results of our study.

Agility was measured by the Illinois agility test. Post-intervention, the agility improved significantly in both the FIFA11+ and the Harmoknee group, with greatest improvement in the former group. The findings of our study is in agreement with the study conducted by, who investigated the effect of 10-week intervention training in young male football players and reported significant changes in the Y20 agility test. Agility is a complex ability which depends on coordination, the mobility of the joint system, dynamic balance, and strength, as well as stabilizing and suppressing strength and speed one potential explanation for the present results could be the fact that our intervention programs included the essential components to improve agility.⁽¹¹⁾ The Illinois test reflects the performance of combined speed and agility.⁽¹⁾ Motor skills common to football such as sprinting and jumping actions, have similarities in muscular, biomechanical, and kinematic characteristics.⁽¹³⁾ During the acceleration period, instantaneous leg power is required to propel the whole body mass to maximum speed in the shortest possible time.⁽¹²⁾

The differences in the results from both the training may be attributed to the fact that FIFA 11+ incorporates few different forms of training elements such as Nordic hamstring, sideway bench, hip out, and hip in, circling partner, shoulder contact, bounding, and plant & cut while Harmoknee warm up program only stress on muscle activation, balance, strength, and core stability training. Many factors influence performance on sport-specific skill tests, including physiological factors (sprint, strength, and power), neural control of movement, and perceptual-cognitive skills such as anticipation and visual search strategies.^(11,14,18) It is likely that

the multifaceted warm-up programs have the potential to increase the stimulus of these factors.

The “FIFA 11+” has been developed for improving neuromuscular control, which has been suggested to be a key element for reducing the injury risk in football players.⁽⁴⁾ In addition to neuromuscular exercises (e.g. balance and stabilization exercises), the “FIFA 11+” also includes sprinting, agility, and polymeric exercises. Since the “FIFA 11+” has been proposed as a warm-up routine, these exercises were needed to provide an adequate physiological stimulus for improving the performance. However, during all these activities, particular attention should be devoted by the operators to the correct execution of the drills and therefore these exercises can be considered as additional neuromuscular training. Although previous studies have examined the effect on physical performance of prevention programs and neuromuscular warm-up.^(6,7,8) We did not expect substantial improvements in performance measures since the stimulus did not appear to be enough for inducing meaningful effects. As a consequence, we hypothesized to find improvement in neuromuscular control, which is also the main aim of the “FIFA 11+”. Indeed, this test involves various components such as balance, postural control, mechanical and reactive stability, and proprioception.^(15,16,17) In addition, the ability to stabilize from a dynamic to a static condition (i.e. transition from an open to a closed kinetic chain position such as when landing from a jump) is a functional and useful skill in sport and particularly in football. Physiological and psychological preparation.^(18,19,20,21) Some of the interesting related studies have been reported in scientific literature.⁽²²⁻²⁶⁾ Risaldar et. al. reported on the Impact of Physiotherapy Rehabilitation Program on Postoperative Acl Tear Patient on Prognosis Leading to Maintain Consistency in Sport.⁽²⁷⁾ Sathe et. al compared the effects of Maitland Mobilization with Conventional Physiotherapy in Adhesive Capsulitis.⁽²⁸⁾ Some of the interesting studies and cases were reported by Goyal et. al.^(29,30) and Jawade et. al.^(31,32) Panchbudhe et. al. reported about the Role of Physiotherapists to Promote Physical Activity in Physical Therapy Settings.

CONCLUSION

Sprint measurements quantified the improvements in running speed by both FIFA 11+ as well as the Harmoknee warm-up program. All the groups FIFA 11+, the Harmoknee and control showed significant improvements in vertical jump height. None of the warm-up programs produced a significant difference in the kicking accuracy of the athlete. Athletes from both groups showed significant improvements in the Illinois agility test whereas no significant changes were seen in the Control group. It is concluded that no clear superiority could be established between FIFA 11+ and the Harmoknee warm-up program. Both the programs improve physical performance in elite football players.

CONFLICT OF INTEREST

Nil

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Nil

ETHICAL CLEARANCE

Taken from institutional ethics committee

CONTRIBUTION BY THE AUTHORS

Dr. Asim Sayyad

Conceptualization of research paper, Literature search, Writing manuscript, Data collection and analysis of the results.

Dr. Milind Kahile

Literature search, Data collection and analysis of the results.

Dr. Neha Deshmukh , Dr. Akshata Guhe

Writing and editing of manuscript

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