

Sustaining Effect of Different Stretching Methods on Power and Agility after Warm-Up Exercise in Soccer Players

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Abstract: The purpose of this study was to investigate enduring effect of static stretching, dynamic stretching and no stretching methods on power and agility in collegian soccer players. Fifteen collegiate soccer players (height: 173.07 ± 7.81 m; mass: 67.60 ± 8.73 kg; age: 24.73 ± 4.59 years; experience: 7.27 ± 2.09) were tested for agility performance using the Illinois agility test and also for power using vertical jump test after warm up completion and at 15 minutes later. Different warm-ups protocols included static stretching, dynamic stretching and no stretching. The current findings showed significant differences on height jump and agility time as compare to static and no stretching methods. There were no significant differences between the first and second posttests after dynamic, static and no stretching methods. We concluded that collegian soccer players probably perform better agility and power after dynamic stretching as compare to static stretching and their muscular performances could be able to sustain in higher level as compare to static stretching.

Key words: Enduring effect • Soccer • Dynamic Stretching • Power • Agility • Warm-up

INTRODUCTION

Soccer is one of the most popular sport team throughout the world which requiring high-intensity, intermittent, non-continuous exercise that includes anaerobic performances such as, agility, power and etc [1-3]. Agility and power contributes to some of the total distance covered during a game which determines to winning possession of the ball and to scoring of goals in soccer [4,5]. Preparation for agility and power should include short- and long-term exercise and training [1,2]. Short-term is a warm-up as pre exercise or pre competition exercise to prepare players for better performance. Stretching program is one of the main sections of warm-up exercise which traditionally static stretching is conducted before soccer training sessions or competitions.

Static stretching is often performed before exercise and athletic performance because it is widely believed that pre-exercise static stretching will decrease the risk of injury and improve performance [6]. However, recent studies [6-10] have shown that static stretching reduces

muscular performance and some others [1,2,11,12] on the other hand, reported that dynamic stretching improves performances. In soccer players, researchers have investigated the acute effect of stretching on the acceleration, maximal speed, agility and vertical jump [1,2] and then reported significantly faster performance after performing dynamic stretching compared to the static stretching.

To date, few studies have evaluated the effects of dynamic stretching on fitness performance. However, there is no study which investigated enduring and sustaining effect of static and dynamic stretching on fitness performances in soccer players. Therefore, there is a practical question that which type of warm up protocol cause to sustain greater power and faster agility in soccer players. Thus, the purpose of current study was to investigate enduring effect of static stretching, dynamic stretching and no stretching methods on power and agility in collegian soccer players. Therefore, it was hypothesized that dynamic stretching would increases power and decrease agility time compared to static and no stretching.

MATERIAL AND METHODS

Participants: Fifteen collegian soccer players (height: 173.07 ± 7.81 m; mass: 67.60 ± 8.73 kg; age: 24.73 ± 4.59 years; experience: 7.27 ± 2.09) were tested as part of their athletic training program. All subjects who had no history of major lower limb injury or disease, volunteered to participate in this study. The university institutional review board gave approval for all procedures. Subjects were required to report to our research laboratory to read and sign a medical questionnaire and an informed consent.

Procedures: The methodology of current study is a quasi-experimental design, in which the subjects were each serving as their own control. A counterbalanced within-subject experimental design was used for this research according to Amiri-Khorasani *et al.* [1,13]. Subjects were, therefore, divided into three groups. Each group performed three different warm-up protocols on three non-consecutive days. The warm-up protocol used

for each group was performed in a randomized manner, which is displayed in Table 1. Subjects performed four minutes jogging, one of the stretching programs (except for NS protocol), rest for 2 minutes and then the vertical jump and Illinois agility tests for one day. Testing sessions conducted with post-intervention measures follow 2 minutes resting time and at 15 minutes after first posttest completion. Subjects sat quietly between the two posttests.

According to Amiri-Khorasani *et al.* [1,13], lower extremity muscles which include gastrocnemius, hamstrings, quadriceps, hip flexors, gluteals and the adductors were selected as target muscles for stretching (Table 2). For each muscle group, subjects held the static stretching for 30 seconds on one leg before changing to the contralateral side. Subjects were instructed to stretch in a slow, deliberate manner with proper body alignment. Static stretching was conducted in accordance with Amiri-Khorasani *et al.* [1,13]. In addition, the same muscle groups that were stretched in the static stretching protocol were chosen for dynamic stretching;

Table 1: Different warm up protocols and testing program during four non-continuous days.

		Days								
		Group 1			Group 2			Group 3		
Protocols		1 st	2 nd	3 rd	1 st	2 nd	3 rd	1 st	2 nd	3 rd
4 min jogging		+	+	+	+	+	+	+	+	+
Stretching		No	Static	Dynamic	Dynamic	No	Static	Static	Dynamic	No
2 min rest		+	+	+	+	+	+	+	+	+
Vertical Jump	First Posttest	+	+	+	+	+	+	+	+	+
Illinois agility test		+	+	+	+	+	+	+	+	+
Vertical Jump	Second Posttest (15 min)	+	+	+	+	+	+	+	+	+
Illinois agility test		+	+	+	+	+	+	+	+	+

(+) denotes activity included.

Table 2: Different static stretching methods for lower group muscles

Muscles	Description
Gastrocnemius	From a push-up position, subject moved his hands closer to his feet to raise his hips and form a triangle. At the highest point of the triangle, subject slowly pressed his heels to the floor, or alternated slowly flexed one knee while kept his opposite leg extended.
Hamstrings	The subject sat on the floor with both legs extended in front of the body, back straight and flexed at the hips, before reaching to touch the feet with the hands.
Hip extensors	The subject flexed the hip, by raising the knee toward the chest with the assistance of the force applied by the hands, which were interlocked behind the raised knee. Hip flexion was synchronized with inhalation.
Hip flexors	The subject stood upright with the legs spread apart, placed the hands on the hips (or one hand on the front knee) and during exhalation flexed the front knee to a 90-degree angle, while keeping the rear knee extended.
Quadriceps	The subject slightly flexed the supporting leg, exhaled and grasped the raised foot with one hand before pulling the heel towards the buttocks during inhalation.
Hip Adductors	The subject sat on the floor with knees flexed so that the feet were touching before replacing the elbows on the inner thighs and pushing the legs towards the floor during exhalation

Table 3: Different dynamic stretching methods for lower group muscles

Muscles	Description
Gastrocnemius	First, the subject raised one foot from the floor and fully extended the knee. Then, the dorsiflexors were contracted intentionally to point to the foot upwards.
Hamstrings	From a standing position with both legs straight, the hip flexors were contracted to swing the leg forwards.
Hip extensors	The subject contracted hip flexors intentionally with knee flexed to bring the thigh to the chest.
Hip flexors	From a comfortable standing position, the subject contracted the hip extensors to swing the leg backwards.
Quadriceps	The subject contracted the hamstrings to flex the leg so that the heel touched the buttocks.
Hip Adductors	The subject contracted hip abductors intentionally with knee extended to swing the leg laterally.

and its procedure was conducted as adopted from Amiri-Khorasani *et al.* [1,13]. As explained in Table 3, subjects were instructed to attempt maximal ROM during each repetition. Each subject intentionally contracted the antagonist of the target muscle in a standing position once every second so that the target muscle was stretched. This stretching was performed five times without any bouncing at each of the three different speed protocols, which were prescribed in the order of slow, moderate and 'fast-as-possible'. The order of target muscles and the rest periods were the same as those in the static stretching.

Measures: Power and agility were evaluated using the vertical jump and Illinois agility tests, respectively. Standardized protocols for fitness testing were followed according to methods previously described [1,2]. The vertical jump was measured using the Vertical Jump Training System (MTAK21, KER, IR). The Electronic timing gates (MTAK16, KER, IR) was used to record the time of Illinois agility test. The best score of three trials was recorded for each fitness test. The same researchers tested the same participants after each warm-up treatment. All testing sessions were performed with identical equipment, positioning, technique and test order (Vertical jump and Illinois agility test). All participants rested at least three min between tests and completed the fitness test battery in about 15–20 minutes. Testing procedures used in this study were designed to be similar to fitness testing procedures which used in the most soccer conditioning programs.

Statistical Analysis: The effect of different stretching methods on power and agility in all players at the first and second posttest was determined using a 2 (pretest) \times 3 (stretching) repeated measure ANOVA. When justified, paired t-tests were performed to confirm significant changes within each condition. The Bonferroni adjustment was then carried out to confirm the significant differences. A significance level of $p = 0.05$ was

considered statistically significant for this analysis. Effect size was = 0.86 and also power was = 0.90. Test-retest reliability values for the testing order of tests ICCRs (intraclass correlation reliability) were = 0.93.

RESULTS

Current finding, as illustrated in Figure 1, showed significant increase in height jump after dynamic stretching (50.40 ± 5.42 cm) against static stretching (47.67 ± 5.35 cm) and no stretching (49.13 ± 3.40 cm) in the first posttest ($p < 0.002$ and $p < 0.05$, respectively); but, there were no significant differences between static stretching and no stretching. In addition, there were no significant differences dynamic (49.90 ± 5.36 cm), static (48.11 ± 5.30 cm) and no stretching (48.49 ± 3.36 cm) in the second posttest.

Results showed decreased agility time significantly follow dynamic stretching (16.68 ± 0.56 s) against static stretching (17.23 ± 0.66 s) and no stretching (16.97 ± 0.88 s) in the first posttest ($p < 0.019$ and $p < 0.05$, respectively); on the other hand, there were no significant differences between static stretching against and no stretching in the second posttest. In addition, there were no significant differences dynamic (16.99 ± 0.57 s),

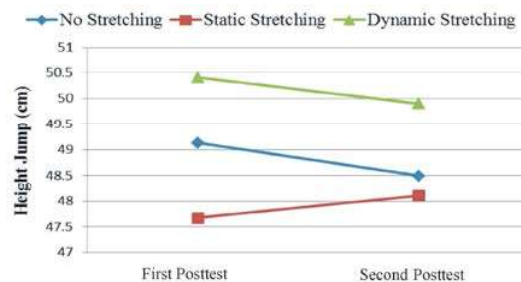


Fig. 1: Height jump after static, dynamic and no stretching in collegian soccer players at the first and second posttests. Dynamic stretching was significantly different from (a) no stretching at $p < 0.05$ and (b) static stretching at $p < 0.002$.

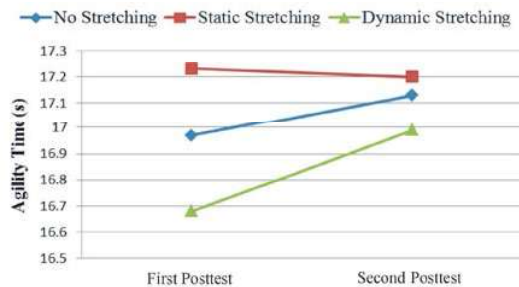


Fig. 2: Agility time after static, dynamic and no stretching in collegian soccer players at the first and second posttests. Dynamic stretching was significantly different from (a) no stretching at $p < 0.05$ and (b) static stretching at $p < 0.019$.

static (17.20 ± 0.56 s) and no stretching (17.13 ± 0.89 s) in the second posttest (Figure 2). Furthermore, there were no significant differences between the first pretest versus the second pretest after dynamic, static and no stretching conditions in height jump and agility time results.

DISCUSSION

The purpose of current study was to investigate sustained effect of static, dynamic and no stretching methods on power and agility in collegian soccer players. Present finding showed significant differences after dynamic stretching compared to the static and no stretching after warm up completion, but, no significant differences between the first (after war up completion) and second (15 minutes after warm up completion) posttests (Figures 1 and 2). Recent evidence has suggested that a bout of static stretching may actually cause acute decreases in vertical jumping ability [14-16]. In contrast, few studies have observed no detrimental effects of stretching on vertical jump kinematics¹⁷ and vertical jump performance [4].

Two hypotheses suggested by previous researchers for the static stretching- induced decrease in performances [10,13,16-18] (a) mechanical factors involving the viscoelastic properties of the muscle that may affect the muscle's length-tension relationship and (b) neural factors such as decreased muscle activation or altered reflex sensitivity. In addition, there are two hypotheses which suggested for positive effect of dynamic stretching: (a) some level of post-activation potentiation (PAP) and (b) increasing muscle temperature. PAP may be a contributing factor to the faster sprint times with the

control condition as well as the lack of stretch- induced deficits in the other conditions [10,13,16]. Therefore, it seems that dynamic stretching by PAP and optimal muscle temperature cause better power and agility performance and in contrast, static stretching cause less power and slower agility due to less muscle stiffness and decreased muscle activation.

Results of this research showed that there were no significant differences between the first pretest versus the second pretest after dynamic, static and no stretching conditions in height jump and agility time results, separately. These findings are similar to Curry *et al.* [19] which reported no significant differences between 5 minutes versus 30 minutes after warm up in untrained females. Although there are no significant differences, but, subjects performed 0.99% and 1.30% shorter in height jump after dynamic and no stretching, respectively, in the second posttest as compare to the first posttest. They performed, on the other hand, 0.92% higher after static stretching in the second posttest as compare to the first posttest. These results showed that muscular performance to resting condition after dynamic and no stretching return, but after static stretching, it attempt to reach resting condition. It seems that in dynamic stretching condition, after 15 minutes, PAP level have decreased therefore height jump records declined after 15 minutes. For static stretching, could be all effects of mentioned reasons during 15 minutes resting inactive because of resting.

However, it seems that dynamic stretching is better than static stretching, because put the muscles in higher level of activation. There were some limitations to show exact and practical effects of dynamic stretching on muscular performance, such as, lake of pretest and resting quietly condition between two posttests. It seems that by conducting pretest we can compare posttests with pretests to show clearer changes. In addition, by conducting some controlled active motions between posttest, we can figure out the rate changes of muscular performances, probably.

CONCLUSION

Dynamic stretching during warm-ups, as compared to static stretching, is probably most effective as preparation for the immediate power and agility required in soccer. Although, there were no significant differences between two posttests, but the records showed that dynamic stretching was in her level of muscular performances.

Therefore, current findings suggest that collegian soccer players should be use dynamic stretching instead of static stretching during warm up to acute preparation for power and agility before training sessions and competitions. According to these results, we suggest to coaches, trainers, fitness coaches and physical educators to use dynamic stretching instead of static stretching in during warm up in collegian soccer players.

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