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Differential stretching protocols during warm up on select performance measures for elite male soccer players

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Abstract

Aim: The purpose of this study was to determine the effects of static stretching, dynamic stretching, and no stretching warm-up trials on 10-m acceleration, 20-m maximal speed, and agility of elite male soccer players. Methods: The participants of this study were 20 elite male soccer players from a competitive high school soccer team (age=16-18). Results: The results of the repeated measures analysis of variance (ANOVA) determined that: 1- There were no significant differences among the different warm-up protocols for 10-m acceleration tests. 2- There were significant differences among the different warm-up protocols for the 20-m maximal speed and agility test, with dynamic stretching resulting in significantly better performance than static and no stretching. Conclusion: Therefore, the research conclude that warm-up protocols that consisted of dynamic exercise resulted in an overall performance enhancement, and static stretching resulted in a detriment performance.

1. Introduction

Soccer is a sport requiring high-intensity, intermittent, non-continuous exercise that includes many sprints of different durations, rapid acceleration, jumping and agility (Akblom1986; Little &Williams2006). According to Stolen (2005) during a 90-minute game elite level players run about 10 km at an average intensity close to the anaerobic threshold 80-90% of maximal heart rate. High speed actions constitute the more crucial moments of the game and contribute directly to winning possession of the ball and to scoring or to conceding of goals (Reilly et al 2000). According to Withers (1982) many instances in soccer demand rapid changes of direction and players make an average of 50 turns per game. The range of sprint distances recorded during games (1.5-105m) indicates the requirements of both acceleration and maximum speed, although players often initiate sprints when already moving at moderate speeds (Young et al 2001). The traditional warm up employed by many coaches typically includes a brief jog followed by a series of static stretches. Static stretches, such as a standing forward bend, are performed...
slowly until the muscle cannot be stretched any further and then held for approximately 30 seconds (Baechle & Earle 2000). However, in recent years, another type of warm-up called dynamic warm-up has become increasingly popular. A dynamic warm-up includes activity-specific movements, such as skips, shuffles, and sprints (Faigenbaum et al. 2005 & 2006a). These stretches are designed to increase body temperature, heart rate, and flexibility (Baechle & Earle 2000; McMillian et al. 2006). This study will investigate the effects of differential stretching protocols during warm-ups for the performance of 10-m acceleration, 20-m maximum speed, and agility tests in elite male soccer players.

2. Methods

2.1 Experimental Approach to the Problem

In a within-subjects experimental design, professional soccer players conducted 3 different warm-up protocols on 3 nonconsecutive test days within one week. Each test day occurred more than 48 hours after a match or hard physical training to minimize the fatiguing effects of previous exercise. The warm-up protocols differed only in the mode of stretching used, whereas all other exercises used in the warm-up were identical. The stretching modes used were static stretch, no stretch and dynamic stretch. Performance tests of acceleration, maximal running speed, and agility were conducted after each warm-up protocol.

2.2 Subjects

The participants in this study are 20 elite male soccer players from a competitive high school soccer team (age=16-18 years). All participants will be familiar with all testing procedures that will be used in this study before the experiment begins. The players are chosen because each subject had previous sprinting and agility experience as part of their prior and current training and sport-specific participation. The participants will not be informed of the results until the study is completed and participants will withdraw if injury or other adverse experience occurs.

2.3 Procedures

Three warm-up protocols differentiated by their stretching content were used: static, no stretch, and dynamic. Subjects conducted these 3 protocols on 3 separate days in that order. Aside from the stretching, each warm-up followed the exact same procedure, consisting of the following:

- 4 minutes of jogging and varied movements, including 2 minutes of jogging, 1 minute of sidestepping and back jogging, and 1 minute of further jogging.
- 6.20 minutes of flexibility exercises (except for no stretch protocol).
- 4 minutes of incremental intermittent sprint and agility runs. These initially included three-quarter pace running: 10 m forward and 5 m sidestepping, repeated twice; 30 m forward, repeated 3 times; and 45 m forward with 5 transformations of direction, repeated twice. Intensity was then increased: three-quarter pace for 10 m and full pace for 20 m, repeated twice and full pace for 30 m.
- 2 minutes of rest.

The principal locomotive leg muscle groups were stretched (gastrocnemius, hamstrings, quadriceps, and hip flexors, gluteals, adductors). The static stretches used were #21 (gastrocnemius), #69 (hamstrings, modified with subject holding own leg), #101 (hip flexor and quadriceps, modified with vertical thigh and trunk alignment) and #114 (gluteals) described by Alter (1996), and the saddle (adductors) described by Hoffman (2002). A 20-second rest was allowed between each stretch. For static stretching, subjects held the stretch for 30 seconds on each leg before
changing immediately to the contralateral side. Subjects were told to stretch until they approached the end of the ROM but within the pain threshold. Subjects performed the dynamic stretches on alternate legs for 60 seconds at a rate of approximately 1 stretch cycle every 2 seconds or unilaterally for 30 seconds, then they repeated on the other leg at a rate of approximately 1 stretch cycle every second. The dynamic stretches used were the backward reach run (quadriceps), lateral lunge (adductors), drop lunge (gluteals) and straight-leg march (hamstrings) described in Fredrick and Szymanski (2001), and the heel-to-toe walk (gastrocnemius), where the subject landed in maximal dorsiflexion and moved to maximal plantar flexion with each step. Subjects were instructed to try and attain maximal ROM with each repetition. In the no stretch protocol, instead of stretching, subjects rested for 1 minute after the general warm-up and then proceeded to complete the incremental intermittent sprint and agility runs.

All performance tests were performed on an indoor synthetic pitch. Stationary 10-m sprint, flying 20-m sprint, and a zig-zag course were used to assess acceleration, maximal speed, and agility capacities. New start Electronic timing gates mat (Brower Timing System, Salt Lake City, UT) were used to measure run completion times respectively. Stationary 10-m sprint involved sprinting 10 m as fast as possible from a stationary start position. Test retest ratio limits of agreement were 0.999/1.042 (bias not significant), showing very good reliability of the 10-m acceleration sprint. Flying 20-m sprint involved sprinting 20 m as fast as possible from a maximal-speed start. Test retest ratio limits of agreement were 0.997/1.040 (bias not significant), showing very good reliability of the 20-m maximal sprint. The 20-m zig-zag course included three 100° turns at 5-m intervals. This test was chosen because of its relative simplicity and the fact that the subjects were all very familiar with the test (having conducted it approximately every 6 weeks during the current and previous seasons), which meant that the learning effects would be minimal. Test-retest ratio limits of agreement were 1.003/1.022 (bias not significant), showing very good reliability of the agility test. During the test session, each subject first performed the stationary 10-m sprint test, the flying 20-m sprint test, and finally the agility test. Subjects performed 2 maximal attempts at each exercise and the best time was retained for analysis. A rest of 2 minutes between trials and tests was included to minimize the effects of fatigue.

2.4 Statistical Procedures

Repeated measures analysis of variance (ANOVA) will be used to compare the performances after the three different warm-up protocols. Benfroni’s post-hoc analysis will be used if necessary and alpha level will be set at 0.05.

3. Results

The mean scores (± SD) for the performance measures after the different warm-up procedures are presented in Table 1. There were significant differences among the different warm-up protocols for acceleration, with dynamic stretching resulting in significantly superior performance than no stretching ANOVA (p=0.025).

In tests for maximal speed, dynamic stretching produced significantly better performance than did static and no stretching ANOVA (p < 0.0005). There were significant differences among the warm-up protocols for agility, with dynamic stretching resulting in significantly better performance than static stretching and no stretching ANOVA (p < 0.0005).

<table>
<thead>
<tr>
<th>Test</th>
<th>No-stretch</th>
<th>Static-stretch</th>
<th>Dynamic-stretch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary 10-m sprint (sec)</td>
<td>1.85±0.08</td>
<td>1.86±0.08</td>
<td>10.87±0.09</td>
</tr>
<tr>
<td>flying 20-m sprint (sec)</td>
<td>3.76±0.07</td>
<td>3.74±0.04</td>
<td>*3.61±0.43</td>
</tr>
<tr>
<td>zig-zag (sec)</td>
<td>6.20±0.16</td>
<td>6.22±0.18</td>
<td>*6.14±0.17</td>
</tr>
</tbody>
</table>
4. Discussion

The results of this study demonstrate that warm-up protocols that consisted of dynamic exercise resulted in a performance enhancement on the 20-m maximal speed and agility tests as compared with a warm-up that consisted of static stretching or no stretching. However, in the 10-m acceleration test the no stretching protocol produced significantly faster runs than did the dynamic or static stretching protocols. These results are consistent with Bishop’s review of literature, indicating that an active, dynamic warm-up of moderate intensity is likely to significantly improve short-term performance on a range of tasks as long as fatigue is not induced. Study results were helpful performance measures in elite male soccer players. The results of analysis allow the author to retain the hypothesis that dynamic stretching was more beneficial to performance than static stretching or no stretching protocols within warm-ups in elite male soccer players (Oliver et al. 2008). Dynamic stretching produced better performance than did static stretching or no stretching in for three of the three tests used.

According to Bishop (2003) an active dynamic warm-up increases the nerve impulses, changes in the force velocity relationship, increases glycogenolysis, glycolysis, high energy phosphate degradation, and enhances power and agility performance. In addition to these temperature related changes, two neuromuscular phenomena possibly activated by the dynamic warm-up could potentially enhance power and agility performance (Sale 2002).

Bishop (2003) suggests that active warm-up also may decrease muscle stiffness by breaking the stable bonds between action and myosin filaments. The following factors should be considered when interpreting the results of the present investigation. First, due to study design and restriction on the availability of subjects repeated measures ANOVA (one each following dynamic, static and no stretching warm-up) were conducted.

Another limiting factor of this study is that physiological parameters of the warm-up protocols were not established. Controlling for factors such as muscle temperature and oxygen utilization would have allowed for greater precision when describing warm-up parameters. Caution should be used when generalizing the results of this study to other populations. Study subjects were young athletes accustomed to vigorous athletic training; older or less athletic populations might respond differently to the warm-up protocols used in this study. Future clinical research should continue to investigate not only the optimal warm-up parameters for duration, intensity and recovery interval, but also the interplay of dynamic, static and no stretching components, sports specificity, environmental conditions and physiological factors.

Result findings show that static stretching or no stretching along before performance of activities that require a high power output can be less effective than dynamic stretching warm-up. The use of short duration static stretching in a soccer precompetition warm-up routine does appear detrimental to subsequent high-speed performance. Therefore, elite male soccer players should incorporate moderate to high intensity dynamic exercises into their warm-up routine. Proper preparation for a soccer game is crucial and a well organized warm-up sharpens an athlete’s mind and body to enable maximal effort. Thus, in sports such as soccer, improvements such as these can have a notable impact on the outcome of the event. Moreover, the most important motor actions in soccer, such as sprinting and shooting, are dependent on high-velocity movements and rate of force development.

5. Conclusions

The results of analysis allow the author to retain the hypothesis that a dynamic stretching warm-up protocol is more beneficial to performance than static stretching or no stretching strategies for elite male soccer players.

References


