Acute effect of specific soccer warm-up on sprint performance after static stretching in amateur female soccer players

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Abstract

While athletes routinely perform warm-up and stretching exercise, it has been suggested that static stretching immediately after the low-intensity aerobic exercise might affect negatively the sprint performance. Due to the fact that in soccer athletes performed specific soccer warm-up before the game, the purpose of this study was to examine the contribution of acute effect of soccer specific warm-up on 20-m sprint performance in 20 amateur female soccer players, after static stretching. All participants performed 3 maximal sprints immediately after the low-intensity aerobic exercise, after static stretching and immediately after specific soccer warm-up. The results of the repeated measures analysis of variance (ANOVA) showed that 20-m sprint impair immediately after static stretching ($p<0.05$) and improved significantly immediately after specific soccer warm-up ($p<0.01$). The findings of this study support the fact that after static stretching a dynamic type of exercise with varied intensity should follow, so that the sprint performance of the soccer players will not be affected negatively.

Key words: *Specific warm-up, static stretching, sprint, female soccer players*

Introduction

Over the last several decades stretching before exercise is considered to prepare the body of the athlete for physical activity and for the game, due to the improvement of range of motion, by contributing to the improvement of physical activity and by decreasing the incidents of injuries (Safran et al. 1989, Sale 2002, Shellock and Prentice 1985, Smith 1994). As a consequence of these positive results, athletes and trainers include stretching in the training programs and during the warm-up before the game (Gleim and McHugh 1997). A classical warm-up archetype generally includes low-intensity aerobic exercise, followed by a series of stretching routines, and finishes with a sport-specific component (Safran et al. 1989).

Among the various stretching techniques that are used today to improve flexibility, the most popular to the male and female athletes and trainers is the static stretching technique (Hedrick 2000, Yamaguchi and Ishii 2005), because they are carried out very easily (Zakas 2005, Yamaguchi and Ishii 2005), and they present a decreased risk of injury (Sady et al. 1982).

Even though male and female athletes carry out static stretching for many decades, before exercise and the game to improve their performance (Kovacs 2006), yet, more recent studies showed that acute static stretching regimens affect the performance of athletes negatively (Alikhajeh et al. 2012, Chaouachi et al. 2008, Curry et al. 2009, Faigenbaum et al. 2006, Fletcher and Jones 2004, Fletcher and Monte-Colombo 2010, Fowles et al. 2000, Gelen 2010, Little and Williams 2006, McHugh and Cosgrave 2010, Needman et al. 2009, Nelson et al. 2005, Pearce et al. 2009, Power et al. 2004, Sayers et al 2008, Winchester et al. 2008, Zakas et al. 2006abc).

In particular, after static stretching studies reported a decrease in the vertical jump and in the strength of the lower extremities (Faigenbaum et al. 2006, Fletcher and Monte-Colombo 2010, Pearce et al. 2009), in muscle strength (Fowles et al. 2000, Power et al. 2004, Zakas et al. 2006abc), in agility (Alikhajeh et al. 2012, Little and Williams 2006), in acceleration (Chaouachi et al. 2008, Nelson et al. 2005, Sayers et al. 2008), and in sprint (Alikhajeh et al. 2012, Chaouachi et al. 2008, Fletcher and Jones 2004, Fletcher and Monte-Colombo 2010, Gelen 2010, Needman et al. 2009, Sayers et al. 2008, Winchester et al. 2008).

The findings of these studies create, of course, a confusion to trainers and athletes regarding the effectiveness of static stretching in the performance during practice and the game, since the negative effect has a duration of two hours upon carrying it out

(Behm et al**.** 2001, Bradley et al. 2007, Brandenburg et al. 2007, Fowles et al. 2000, Power et al**.** 2004), and the beginning of the game, as well as its development are taking place during that time.

The results of these studies, though, come from protocols that were applied in laboratory conditions, where no other movement activity interposed after static stretching. Young and Behm (2003), however, reported as reverse the negative effects that are caused by static stretching in activities of power and strength, when immediately after applying those, activities of dynamic type are carried out. In ballgame sports, though and more particular in soccer after static stretching, a specific warm-up for the sport is carried out, which includes dynamic movement activities and activities of the sport of dynamic type.

Due to the fact that athletes in general, and especially soccer athletes apply static stretching during warm-up, before practice or the game and its immediate effect in sprint seems to be negative, it would be useful for the trainers, and for the athletes themselves to know about the role of specific warm-up in sprint, immediately after static stretching, considering the fact that in soccer the specific part of warm-up includes dynamic movement activities that simulate the game movement of the sport, since sprint is important for the performance of the athletes in the game.

Therefore, the purpose of the present study was to examine the contribution of acute effect of soccer specific warm-up on sprint performance in amateur female soccer players, after static stretching.

Materials and methods

Subjects

Twenty (20) amateur female soccer players aged 22.4±0,45y volunteered to participate in the study. All participants agreed to maintain their normal exercise and activity levels throughout the duration of the study. All subjects were healthy, with no history of musculoskeletal or neurological disease. A sport medicine accredited doctor examined each female player physically before the beginning of the study, and the nature, purpose and possible risk involved in the study was explained to the subjects before receiving their informed written consent for participation. The study was conducted according to the rules and regulation of the research ethics committee of the Aristotle University of Thessaloniki.

Procedures of protocol

All participants performed the same exercise protocol, which consisted of a) a general warm -up of 8-min duration b) initial measurement of 20-m straight sprint c) static stretching of 6-min duration d) second measurement of 20-m straight sprint e) specific soccer warm- up of 13-min duration and f) final measurement of 20-m straight sprint. The general warm-up was low-intensity aerobic exercise, and it includes jogging with or without a ball in various directions, as it is carried out in the general part of warm-up before the game.

The flexibility protocol included classical stretching exercises of static type of the muscle of lower extremities. The working muscle groups should be adductors, hamstrings, quadriceps, posterior of tibia muscles and hip flexors. Every stretching exercise had 10 seconds duration, was carried out in turns for every leg and was repeated one more time (2X10´´) for every leg, without any breaks. For all stretching exercises the stretching positions were assumed gently and slowly until the actual and-point of range. This position was a terminal one, which was defined as the point at which the subject felt the stretch without any pain.

The specific warm-up was carried out with a higher intensity and an alternative rate and it included movements that simulated those of a game. The specific warm-up included: a) a 15-m jog with a progressive intensity b) a game of 5 players versus 5, of 2 minutes duration in a space of 40X30m. c) an energetic rest break, between the game and the next exercise, of 1 minute duration d) an exercise of regular cooperation of high intensity with a 60 sec duration that was repeated twice e) an energetic rest break, between the regular exercise and the next one, of 1 minute duration f) a 2X10m. sprint in a straight line, with an intermediate break of 30 seconds, g) a 2X10m. sprint with changing direction with an intermediate energetic break of 30 seconds h) a 1 minute energetic break of rest. The energetic break included, always, simple marching and breathing exercises, with no static stretching.

The protocol was applied in the racing part of the field by two experienced examiners, who carried out a particular work. During the study, each examiner had the same task. The female athletes that were examined were given preliminary directions regarding carrying out the protocol and they were given motivation during the sprint.

Running velocity test

All subjects performed individually two maximum trials of each test of 20-m straight sprint, with at least 2 minutes of rest between all trials of the 3 tests. The best performances in each test were used for analysis. The protocol was conducted > 48 hours following a competition or hard physical training to minimize the influence of fatigue on test performance. The measurements were made using Newtest Powertimer 300 type of photocells, (PC Upgrade Kit, FIN 90220 Oulu, Finland). Two photocells were place in 20-meters distance, as instructed by the manufacturer. The first photocell was placed at the starting line (0 meters) and the second one at the finishing line at 20 meters. Each female soccer player started 40 centimeters before the first photocell and developed maximum speed by the final cone, which was placed 5 meters after the second photocell, in order to ensure that the decrease in the speed will be avoided before the finishing line of 20m. The photocells were placed 80 centimeters above the ground.

Statistical analysis

Analysis of Variance (ANOVA) with repeated measurements was applied for each dependent variable. When significantly different values were found a Scheffe post hoc analysis was applied to determine the statistical significance of the difference in the mean value. A criterion level of $p<0.05$ was selected for all analyses.

Results

The statistical analysis revealed a significant main effect for sprint test ($F_{(2,38)} = 7.14$, $p<0.001$), indicating that static stretching as well as specific warm-up affects positively or negatively the sprint performance. The Scheffe post hoc analysis showed significant impair in sprint performance after carrying out static stretching ($p<0.05$) (time 2) and a reversal, as well as an equivalent improvement in sprint upon the specific warm-up ($p<0.01$). No significant differences between the initial (time 1) and the final sprint (time 3) were observed (figure 1).

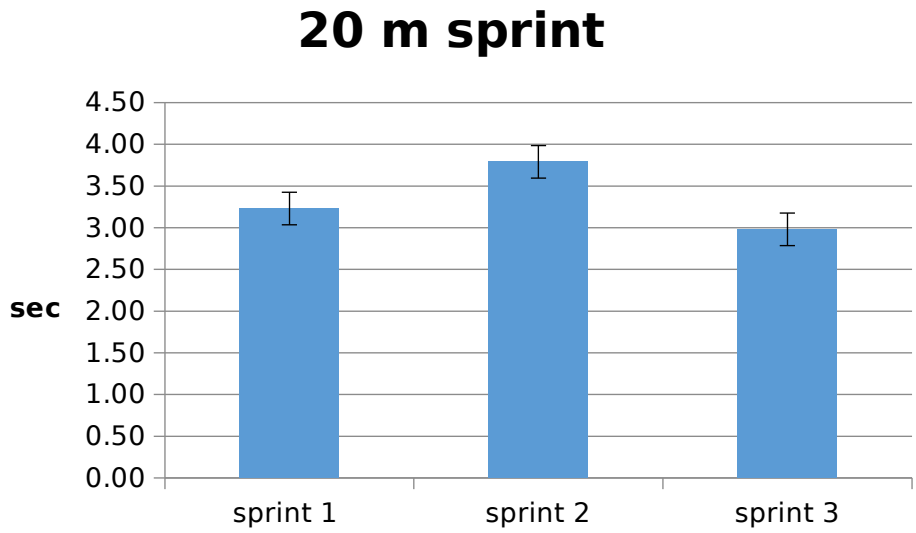

Figure 1. 20-m sprint of amateur female soccer players, before applying static stretching (sprint 1), immediately after applying static stretching (sprint 2) and immediately after specific soccer warm-up (sprint 3) (**p<0.01, *p<0.05).

Discussion

In the present study the acute effect of specific warm-up after static stretching in 20m sprint was examined in 20 amateur female soccer players in actual conditions in the soccer field, given that in literature the acute effect of static stretching in sprint in laboratory conditions is examined, which means that there is no dynamic type of exercise upon the static stretching, while in actual conditions, in the warm-up before the game, static stretching is applied immediately after the low-intensity aerobic warm-up exercise and before the specific that follows and simulates with dynamic type of movements attempts that are made during the game.

The finding of the present study showed that the 10 sec static stretching, repeated two times, significantly impair on sprint 20-min amateur female soccer players. Our results agree with respective studies which show similar results (Alipasali 2012, Kyranoudis 2013, Fletcher and Monte-Colombo 2010, Gelen 2010, Needman et al. 2009, Sayers et al. 2008, Winchester et al. 2008, Nelson et al. 2005, Fletcher and Jones 2004).

No data collected in the present study could suggest a specific mechanism explaining the results. However, various authors have speculated about the mechanism that explains the stretching-induced impair in sprint. Neural inhibition (Behm et al. 2001, Fowles et al. 2000) and mechanical factors involving the viscoelastic properties of the

muscles that may affect the muscles length-tension relationship (Nelson et al. 2001) have been suggested as possible mechanism. The decreased temperature of the muscles after the static stretching might be another possible factor for the deterioration of the sprint (Hedrick 2000, Mohr et al. 2004). Pearce and his associates (2009) suggest that a period of static stretching after the low-intensity aerobic warm-up leads to reversing the positive effect that low-intensity aerobic warm-up has on the athlete. Tissue damage is another possibility explaining acute performance decrement, because the long duration of static stretching can significantly increase muscle soreness and muscle damage, as indicated by elevated creatine kinase in the blood (Smith et al. 1993). However, the precise mechanism that leads to stretch-induced on sprint impair is still not clear (Behm et al. 2001).

The findings of the present study also showed a reverse and equivalent improvement on the sprint that was carried out after the specific warm-up in the female soccer players. The findings of the present study are in accordance with those of Tailor and his associates (2009), and Alipasali (2012), Kyranoudis (2013) who found a similar reversal in the sprint in amateur volleyball female athletes and male soccer players, respectively and in disagreement with the results of Stewart et al. (2007) and Pearce et al. (2012). Our contradictory results may have occurred due to the different methodological approach. In the present study the specific warm-up that was carried out after static stretching was similar to the specific warm-up of the soccer sport, while in Stewart et al. (2007) study specific warm-up included 3 sprints of 40 meters and in Pearce et al. (2012) study the intensity of the specific warm-up was low, almost like the intensity of the low-intensity aerobic warm-up.

The increased temperature of the muscles and the body that occur due to the dynamic movement attempts during the specific warm-up, seems that might contribute to the reverse and equivalent improvement of the sprint of female soccer. Hedrick (2000) suggests that the increased temperature of the muscles helps, in order for the muscle contraction to be achieved more dynamically and for the relaxation to be achieved faster. According to Bishop (2003), more warm-up time leads to the increase of the temperature of the muscles and the speed of the nerve impulses, while static stretching reduces the heart rate (Fletcher and Monte-Colombo 2010). The increase of the temperature of the muscles and the body which is caused by the increase of the heart rate seems to cause a decrease in the resistance of the muscles and the joints (Fletcher and Monte-Colombo 2010) and an increased sensitivity of the neurological sensors,

which possibly increases the speed of nerve impulses and to enhance muscle contraction, in order for it to be faster and stronger (Shellock and Prentice 1985). The above hypothesis is supported by the study of Pearce and his associates (2009), where heart rate was low (88,3±4,2 bpm), after static stretching and higher (121,4±1,85 bpm), after specific warm-up. The results of Fletcher and Monte-Colombo (2010) also showed a similar increase in heart rate. Even though in the present study the temperature of the muscles of the female soccer players was not measured, perspiration was observed to all players, which shows an increase in the temperature of the muscle and the body and might explain the reverses on sprint.

Conclusion

A stretching session with static lengthening, without causing pain, lasting for 6 min who performed after low-intensity aerobic exercise during soccer warm-up induce significant losses in 20-m straight sprint in amateur female soccer players. However, the specific warm-up of the soccer sport which follows not only reverses the losses, but it also improves significantly the sprint of these athletes. The findings of this study support that after static stretching a dynamic type of exercise of varied intensity should follow, so that the sprint performance of these female soccer players is not affected negatively. Results from the present study might prove to be useful to athletes who desire to increase their sprint during warm-up procedure, prior to competition, as well as to trainers who incorporate dynamic type exercises after static stretching routine exercises.

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