Static versus dynamic stretching: Chronic and acute effects on Agility performance in male athletes

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Abstract

The purpose of this study was to examine the acute and chronic effects of static & dynamic stretching protocols on agility performance in amateur handball players. Twelve male amateur handball players (age: 19.66 ± 4.02 years old, weight: 67.12 ± 8.73 kg, height: 178.29 ± 7.81 cm) participated in this study. The athletes were randomly allocated into two groups: static stretching or dynamic stretching. All of them underwent an initial evaluation and were submitted to the first intervention. They were evaluated once again and at the end of 12 training sessions. The results analyzed using ANOVA showed that there was a significant decrease in agility time after dynamic stretching against no stretching in the acute phase; but, there were no significant differences between dynamic stretching and no stretching in the chronic phase. In addition, there was no a significant difference between no stretching and static stretching in the acute phase; while, There was a significant decrease in agility time after no stretching against static stretching in the chronic phase. It was concluded that acute dynamic stretching as part of a warm-up may decrease agility time performance, whereas static stretching seems to increase agility time performance. Consequently, the acute and chronic static stretching should not be performed prior to an explosive athletic performance.

Keywords: Handball, Agility, Dynamic stretching, Static stretching

1. Introduction

Handball is considered to be one of the most explosive and fast paced sports today requiring highly developed qualities of muscular fitness such as speed, power and agility. Agility can be defined as quick, full-body changes in direction and speed or simply the ability to change direction (Brughelli, et al., 2008). Any casual observer of the sport can describe the importance of such a skill in athletic performance (Hoffman, et al., 2012). Most, if not all, field or court sports require agility for competition (Hoffman, et al., 2012). For example, soccer, American football,
basketball, volleyball and handball clearly depict the prevalence of agility in sport. Preparation for agility and other performance training should involve both long and short-term preparations (Amiri-Khorasani, et al., 2010). Long term preparation may include a well-developed agility training program, while short-term preparation should include a warm-up (Behm, et al., 2001; Burkett, et al., 2005). Many athletes perform stretching exercises as part of a warm-up prior to physical activity in order to prevent injuries and enhance their performance through an increase in flexibility (Alter, 1998; Herbert, et al., 2002). However, conventional beliefs regarding the routine practice of pre-event static stretching have recently been questioned (Shrier, 2004; Thacker, et al., 2004). Several studies have shown that acute static stretching exercises that are commonly used by athletes prior to training or competition may impair muscular speed and agility (Amiri-Khorasani, et al., 2010; Cornwell, et al., 2002; McMillian, Haller, et al., 2006; Winchester, Young, et al., 2008). For example, McMillian, (2006) and Amiri khorasani (2010), demonstrated the negative effects of acute static stretching on Jumping and agility after static stretching, while others report that acute static stretching has no effect at all on performance (Church, et al., 2001; Samuel, et al., 2008). Therefore, some researchers suggested that players should not use static stretching before activities that depend on high degrees of strength and power (Bacurau, et al., 2009; Fowles, et al., 2000). Since even a 1% change in performance can have a noticeable influence on the outcome of an athletic event in both individual and team sports. On the other hand, reported that acute dynamic stretching improves performances. In elite and amateur players, researchers have investigated the acute effect of stretching on the maximal speed, agility and power and then reported significantly faster performance after performing dynamic stretching compared to the static stretching (Amiri-Khorasan, et al., 2010; Faigenbaum, et al., 2005; Fattahi-Bafghi, et al., 2012; Hodgson, et al., 2005; Needham, et al., 2009; Taleb-Beydokhti, et al., 2014). Furthermore, Amiri-Khorasani et al. (Amiri-Khorasani, et al., 2010) and Van et al. (Van Gelder, et al., 2011) demonstrated the positive effects of dynamic stretching on agility performance. Although there are studies documenting the detrimental acute effects of static stretching and useful acute effects of dynamic exercises, to date, no studies have researched the chronic effects of different stretching methods, specifically for agility performance. Thus, the purpose of this study was to examine the Acute and chronic effects of static & dynamic stretching protocols on agility performance in amateur handball players.

2. Materials and methods

Twelve male handball players (age: 19.66 ± 4.02 years old, weight: 67.12 ± 8.73 kg, height: 178.29 ± 7.81 cm) 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. Instructed not to engage in lower – body exercise 48 hours before their test, to eliminate any potential muscle soreness or fatigue. All sessions were performed at the same time of day (± 1 hrs.) for each participant. All participants received a clear explanation of the study, including the risks and benefits of participation and written informed consent for testing was obtained from all participants.

Evaluation protocol:

The athletes received an explanation about the evaluation protocol at the first moment. The evaluations were held before and immediately after the first training (acute effect), and at the end of the training protocol (chronic effect) (figure 1).

Figure 1. Study chart
Each athlete was submitted to a stretching protocol, which consisted different types of stretching in each group during the period of 12 interventions. Participants were involved in 2 training sessions each week. The static stretch (SS) protocol consisted of 7 minutes of low-intensity jogging followed by 10 minutes of static stretching emphasizing the lower-extremity muscle groups: gastrocnemius, quadriceps, hip flexors, adductors, hamstrings, and gluteal, according Taleb-Beydokhti (Taleb-Beydokhti, et al., 2014). The technique of static stretching required the subjects to slowly take up the stretch of the muscle to the point of tension and mild discomfort and hold for a period of 30 seconds. It means that, they performed one stretching for 15 seconds on right leg and 15 seconds on left leg.

The dynamic stretch (DS) protocol consisted of 7 minutes of low-intensity jogging followed by 10 minutes of dynamic stretching emphasizing the same muscle groups included in the SS protocol were adopted from Taleb-Beydokhti (Taleb-Beydokhti, et al., 2014).

**Performance test:**

**Illinois Agility Test:**

The length of the course is 9.15 meters and the width (distance between the start and end points) is 5 meters. Four cones are used to mark the start, finish and the two turning points. Another four cones are placed down the center an equal distance apart. Each cone in the center is spaced 3.3 meters apart. Subjects should lie on their front (head to the start line) and hands by their shoulders. On the ‘Go’ command the stopwatch is started, and the athlete gets up as quickly as possible and runs around the course in the direction indicated, without knocking the cones over, to the finish line, at which the timing is stopped.

**Statistical Analysis:**

All calculations were performed using the Statistical Package for Social Sciences version 18 (SPSS 2010). The effect of different stretching methods on agility in all players was determined using one-way analysis of variance for repeated-measures. Paired t-tests were performed to determine significant changes within each condition. A significance level of $p \leq 0.05$ was considered statistically significant for this analysis.
3. Results

Current finding, as illustrated in Figure 2, showed significant decrease in time Illinois agility test after dynamic stretching (17.52±1.19) against no stretching (18.26±1.12) and 12 dynamic stretching sessions (18.45±0.94) (p < 0.024 and p < 0.030, respectively); But, there were no significant differences between 12 dynamic stretching sessions (18.45±0.94) and no stretching (18.26±1.12).

![Figure 2. Agility after no stretching, dynamic stretching and 12 dynamic stretching sessions in handball players. (a) Is a significant difference after dynamic stretching (acute effect) against no stretching and 12 dynamic stretching sessions (chronic effect) and (b) no a significant difference after 12 dynamic stretching sessions (chronic effect) against no stretching.](image)

Current finding, as illustrated in Figure 3, showed significant decrease in time Illinois agility test after no stretching (18.80±0.95) against 12 static stretching sessions (19.46±0.68) and static stretching (18.70±0.94) against 12 static stretching sessions (19.46±0.68) (p < 0.042 and p < 0.002, respectively); But, there were no significant differences between no stretching (18.80±0.95) and static stretching (18.70±0.94).
4. Discussion

Despite the wide use of stretching techniques during pre-competition training as improvement for performances, there is controversy and little conclusive scientific evidence which supports this idea. The purpose of this investigation was to determine the acute & chronic effect of static stretching, dynamic stretching, no stretching methods on agility performance in handball players. In previous research it has been recommended to use dynamic stretching as the primary method of stretching pre-event warm-up before high speed, and power activities (Amiri-Khorasani, et al., 2010; Little, et al., 2006). The findings of this study agree with that recommendation for agility activities as well. Results revealed significant improvements after dynamic stretching (acute effect) compared to the no stretching and 12 dynamic stretching sessions (chronic effect) in dynamic stretching groups (figures 2). On the other hand, there were no significant differences between 12 dynamic stretching sessions and no stretching. The findings of the current study are consistent with those of Turki-Belkhiri and Lamia (2014), and Amiri-Khorasani (2010) who determined that dynamic stretching elicits the best performance in power and high-speed activities. In addition, in static stretching group, there were no significant differences between no stretching and static stretching. On the other hand, there were a significant difference after static stretching and no stretching against 12 static stretching sessions (figures 3). The findings of the current study are consistent with those of Mc Millian, (2006) and Amiri Khorasani (2010). We provide evidence that pre-event acute and chronic static stretching may be suboptimal for preparing male handball players for activities that require a high power output. Therefore, two hypotheses suggested by previous researchers for the static stretching induced
decrease in performances: (1) mechanical factors involving the viscoelastic properties of the muscle that may affect the muscle’s length tension relationship, and (2) neural factors such as decreased muscle activation or altered reflex sensitivity (Cornwell, et al., 2002; McNeal, et al., 2003). In addition, there are two hypotheses which suggested for positive effect of dynamic stretching: (1) increasing muscle temperature and (2) some level of post-activation potentiation (PAP) (Amiri-Khorasani, et al., 2011; Yamaguchi, et al., 2006). PAP may create an optimal environment for athletic performance by increasing phosphorylation of the regulatory myosin light chains, enhancing neuromuscular function, or possibly changing pennation angle (Tillin, et al., 2009). In contrast, few studies have observed no detrimental stretching-induced effects on agility performance (Faigenbaum, et al., 2006). It seems that this conflict is the result of differences in participants’ characteristics, methodology, training experience and the recovery period. Therefore, it seems that dynamic stretching by post-activation potentiation and optimal muscle temperature cause better performance and in contrast, static stretching cause less performance due to decreased muscle activation and less muscle stiffness (Amiri-Khorasani, et al., 2013). However, there is no significant decrease after 12 dynamic stretching sessions (chronic effect); it could be that players did not respond to 12 dynamic stretching sessions better than dynamic stretching (acute effect) because of their amateur level. In conclusion, warm-up with dynamic stretching led to the significant improvement in agility performance. These changes can be due to an increase in muscle temperature, similar patterns of motion exercise, Increase in muscle force and rate of force development followed an active contraction (PAP) (Taleb-Beydokhti, et al., 2014). These finding suggest acute dynamic stretching has greater applicability to enhance performance compared to acute and chronic static stretching. According to these results, we suggest to coaches and trainers to use acute dynamic stretching instead of static stretching in during warm-up in amateur handball players. Future studies should look at the acute and chronic effects of different dynamic stretching methods on explosive performances in elite handball players and should explore the impact of varying the stretching duration, intensity, and recovery time on anaerobic performances.

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