Acute Effect Different Stretching Methods During Warm Ups on Agility and Power in Amateur Handball Players

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Abstract: the purpose of this study was to examine the acute effects of different stretching protocols on power and agility in amateur handball players. Twelve male amateur handball players (age: 22.66±4.02 years old, weight: 67.12±8.73 kg, height: 178.29±7.81 cm) performed 3 different warm-up protocols in randomly assigned order: (a) no stretching (NS), (b) static stretching (SS) and (c) dynamic stretching (DS). The results analyzed using ANOVA showed that there was a significant decrease in agility after DS vs. SS and NS (p < 0.037 and p < 0.003, respectively); but there were no significant differences among NS vs. SS. In addition, there was no a significant difference in height vertical jump after DS against SS and NS groups. But, DS and NS showed better record than SS groups. Although additional research is needed to optimize stretching procedures for athletes and to better understand the influence of dynamic stretching protocols on anaerobic performance, the available data indicate that dynamic stretching activities can have a favorable influence on athletic performance.

Key words: Handball - Agility - Anaerobic Power

INTRODUCTION

Handball is considered to be one of the most explosive and fast paced sports today requiring highly developed qualities of muscular fitness [1-3]. 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 [4, 5]. However, conventional beliefs regarding the routine practice of pre-event static stretching have recently been questioned [5-8]. Several studies have shown that static stretching exercises that are commonly used by athletes prior to training or competition may impair muscular speed, power and agility [9-12]. But others report that static stretching has no effect at all on performance [13-15]. This stretching-induced effect is thought to be related to a decrease in neural activation, reduced musculotendinous stiffness, or a combination of neural and muscular factors [16, 17]. Therefore, some researchers suggested that players should not use static stretching before activities that depend on high degrees of strength and power [17, 18], 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, the dynamic general or specific explosive movements that are typically performed during warm-up may induce a phenomenon called post-activation potentiation (PAP) that enhances muscular power [2, 19-24]. Although some observers suggest replacing pre-event static stretching with dynamic exercise [25, 26], more research is needed to support such recommendations. Thus, the purpose of this study was to examine the acute effects of static stretching, dynamic stretching and no stretching methods on agility and power in handball players.

MATERIALS AND METHODS

Subjects: Twelve male handball players (age: 22.66±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. Subjects were instructed not to engage in lower body...
Table 1: Counterbalanced order for three Different warm-up groups

<table>
<thead>
<tr>
<th>Days</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
</tr>
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<tbody>
<tr>
<td>Group 1</td>
<td>NS</td>
<td>SS</td>
<td>DS</td>
</tr>
<tr>
<td>Group 2</td>
<td>DS</td>
<td>NS</td>
<td>SS</td>
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<tr>
<td>Group 3</td>
<td>SS</td>
<td>DS</td>
<td>NS</td>
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</tbody>
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(NS) No stretching; (SS) Static stretching; (DS) dynamic stretching

exercise 48 hours before their test, to eliminate any potential muscle soreness or fatigue. 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.

**Procedure:** 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. All subjects were familiar with the stretch protocols and performance tests. Nevertheless a group session prior to testing was included to testing procedures and the different modes of stretching. Subjects were divided into three groups, that is, each group included three subjects. Each group performed three different warm-up protocols for 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 seven minutes jogging, one of the stretching programs (except for NS protocol), rest for 2 minutes and then the vertical jump and Illinois test on one day.

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 (Table 2 for more details). 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.

**Table 2: Static stretches protocol (SS)**

<table>
<thead>
<tr>
<th>Static stretching protocol</th>
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<tbody>
<tr>
<td>Hamstrings</td>
</tr>
<tr>
<td>Quadriceps</td>
</tr>
<tr>
<td>Hip flexors</td>
</tr>
<tr>
<td>Hip Adductors</td>
</tr>
<tr>
<td>Gastrocnemius</td>
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<tr>
<td>Gluteus</td>
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**Table 3: Dynamic stretches protocol (DS)**

<table>
<thead>
<tr>
<th>Dynamic flexibility protocols</th>
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</thead>
<tbody>
<tr>
<td>Walking lunge</td>
</tr>
<tr>
<td>Knees to Chest</td>
</tr>
<tr>
<td>Butt kicks</td>
</tr>
<tr>
<td>High knees</td>
</tr>
<tr>
<td>Side Lunge stretch</td>
</tr>
<tr>
<td>Straight Leg Kicks</td>
</tr>
<tr>
<td>Side leg-swings</td>
</tr>
</tbody>
</table>
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 (Table 3 for more details). The intensity of the dynamic movements progressed from moderate to high intensity. In the no stretching, subjects rested for 2 minutes after the general warm-up before performing the fitness tests.

**Performance Test:**

**Vertical Jump Test:** The athlete stands side on to a wall and reaches up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips is marked or recorded. This is called the standing reach height. The athlete then stands away from the wall and leaps vertically as high as possible using both arms and legs to assist in projecting the body upwards. Attempt to touch the wall at the highest point of the jump. The difference in distance between the standing reach height and the jump height is the score. The best of three attempts is recorded.

**Illinois Agility Test:** The length of the course is 10 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 power 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. The Bonferroni adjustment was then carried out to confirm the significant differences. A significance level of $p \leq 0.05$ was considered statistically significant for this analysis.

**RESULTS**

Current finding, as illustrated in Figure 1, showed significant decrease in time Illinois agility test after dynamic stretching (18.01±1.12) against static stretching (18.25±1.10) and no stretching (18.53±1.03) ($p < 0.037$ and $p < 0.003$, respectively). But, there were no significant differences between no stretching (18.53±1.03) and static stretching (18.25±1.10).

Current finding, as illustrated in Figure 2, showed no significant differences in height jump after dynamic stretching (49.00±5.16) against static stretching (48.08±5.98) and no stretching groups (48.41±5.91). But, dynamic stretching (49.00±5.16) and no stretching (48.41±5.91) showed better record than static stretching groups (48.08±5.98).

**DISCUSSION AND CONCLUSION**

The purpose of this investigation was to determine the acute effect of static stretching, dynamic stretching and no stretching methods on agility, power and speed in amateur handball players. Results revealed significant improvements after dynamic stretching compared to the static stretching (Figures 1). On the other hand, there were no significant differences between static stretching and no stretching. In addition, in power result, there were no significant differences between dynamic stretching against static stretching and no stretching. But, dynamic stretching and no stretching showed better record than static stretching groups (Figures 2). We provide evidence that pre-event static stretching may be suboptimal for preparing amateur handball players for activities that require a high power output. Recent evidence has suggested that a bout of static stretching may actually cause acute decreases in vertical jumping and Illinois agility ability [10, 11]. 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 [9, 11, 27]. 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) [24, 27, 28]. 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 [29]. Also, an increase in muscle temperature and muscle blood flow as a result of dynamic stretching may induce a more forceful and quicker muscle contraction by increasing the speed of nerve impulses [30] and the force-generating capacity of muscle cells [31].
However, there is one study that reported conflicting results [32] regarding agility records. Yet this conflict could be the result of differences in training experience, methodology 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 [33]. In conclusion, warm-up with dynamic stretching led to the significant improvement in power and 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).

These finding suggest dynamic stretching has greater applicability to enhance performance compared to static stretching. According to these results, we suggest to coaches and trainers to usedynamic stretching instead of static stretching in during warm-up in amateur handball players.

REFERENCES