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Acute and Chronic Effects of Static and Dynamic Stretching Protocols on Change of Direction Performance in Handball Players

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Abstract: The purpose of this study was to examine the acute and chronic effects of static and 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 after dynamic stretching against no stretching in the acute phase; But, there were no significant differences between 12 dynamic stretching sessions 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 after no stretching against 12 static stretching sessions in the chronic phase. The results of this study suggest that it may be desirable for amateur handball players to perform acute dynamic stretching before the performance of activities that require a high power output.

Key words: Handball · Agility · Dynamic Stretching · Static Stretching

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, agility. Agility can be defined as quick, full-body changes in direction and speed or simply the ability to change direction [1]. Any casual observer of the sport can describe the importance of such a skill in athletic performance. Most, if not all, field or court sports require agility for competition. 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. Long term preparation may include a well-developed agility training program, while short-term preparation should include a warm-up [2, 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 [6, 7]. Several studies have shown that static stretching exercises that are commonly used by athletes prior to training or competition may impair muscular speed and agility[8-11]. But others report that static stretching has no effect at all on performance [12, 13]. Therefore, some researchers suggested that players should not use static stretching before activities that depend on high degrees of strength and power [14, 15]. 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 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 [8, 16-21] Although there are studies documenting the detrimental effects of static stretching and useful effects of dynamic exercises, to date, no studies have researched the acute and chronic effects of different stretching methods,

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specifically for agility performance. Thus, the purpose of this study was to examine the Acute and chronic effects of static and dynamic stretching protocols on change of direction performance in handball players.

MATERIALS AND METHODS

Subjects: 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. Subjects were instructed not to engage in lower-body 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.

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).

Stretching Protocols: Each athlete was submitted to a stretching protocol, which consisted different types of stretching in each group during the period of 12 interventions. 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 1 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 [22].

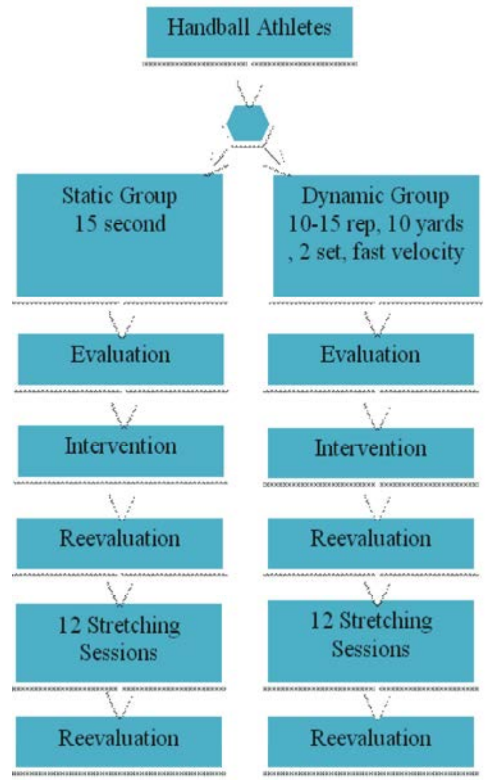

Fig. 1: Study chart

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 2 for more details). In the no stretching, subjects rested for 2 minutes after the general warm-up before performing the fitness tests.

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.

Table 1: Dynamic stretches protocol (DS)

Dynamic flexibility protocols	
Walking lunge	From a standing position, Step forward with right leg and lower your body to 90 degrees at both knees.
Knees to Chest	The subject contracted hip flexors intentionally with knee flexed to bring the thigh to the chest.
Butt kicks	Stand with your feet pointed straight ahead and placed shoulder-width apart. Contract your gluteus and bring your heel to your gluteus.
High knees	Run forward with short, quick steps, pumping your knees into the air and flexing your hip, knee and foot. Keep your chest up.
Side Lunge stretch	Standing with feet hip-width apart, step out to the side with your right foot. Keep left leg straight and bend into a lunge in the right leg.
Straight Leg Kicks	From a standing position with both legs straight, the hip flexors were contracted to swing the leg forwards.
Side leg-swings	From a standing position, Swing your straight leg left to right in wide arcs between the wall and your standing leg.

Table 2: Static stretching protocol

	Static stretching protocol
Hamstrings	Sit on the ground with both legs straight out in front of you, Bend the left leg and place the sole of the left foot alongside the knee of the right leg, Bend forward keeping the back straight.
Quadriceps	Holding on to a chair or wall if necessary, lift your right foot up to your bum and grab your ankle with your right hand, Now repeat with the opposite leg.
Hip flexors	From a kneeling position, bring the left leg out front with foot flat on the ground. Push body forward through the hips, stretching that right hip flexor.
Hip Adductors	Stand tall with your feet approximately two shoulder widths apart, Bend the right leg and lower the body, Keep you back straight and use the arms to balance, You will feel the stretch in the left leg adductor,Repeat with the left leg.
Gastrocnemius	Stand tall with one leg in front of the other, with hands pressing against a wall at shoulder height. Ease your back leg further away from the front leg, keeping it straight (but not locked) and press the heel firmly into the floor. Keep your hips facing forward and the rear leg and spine in a straight line. You will feel the stretch in the calf of the rear leg, Repeat with the other leg.
Gluteus	Sitting tall with legs stretched out in front of you, Bend the right knee and place the right foot on the ground to the left side of the left knee, Turn your shoulders so that you are facing to the right, Using your left arm against your right knee to help ease you further round, Use your right arm on the floor for support, You will feel the stretch along the length of the spine and in the muscles around the right hip.

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.

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.

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).

Figure 3. Agility after no stretching, static stretching and 12 static stretching sessions in handball players. (a) No a significant difference after no stretching against static stretching and (b) is a significant difference after no stretching against 12 static stretching sessions and static stretching (acute effect) against 12 static stretching sessions (chronic effect).

DISCUSSION

The purpose of this investigation was to determine the acute and chronic effect of static stretching, dynamic stretching no stretching methods on agility in handball players. 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. In a ddition, in static stretching group, there were no significant differences between no stretching and static stretching. On the other hand, there were a significant differences after static stretching and no stretching against 12 static stretching sessions (figures 2). We provide evidence that pre-event acute and chronic static stretching may be suboptimal for preparing female handball players for activities that require a high power output. Recent evidence has suggested that a bout of static stretching may actually cause significant decreases in Illinois agility test ability [8, 10]. Therefore, two hypotheses suggested by previous researchers for the static stretching induced decrease in performances: mechanical factors involving the viscoelastic properties of the muscle that may affect the muscle`s length tension relationship and neural factors such as decreased muscle activation or altered reflex sensitivity [9, 11]. In addition, there are two hypotheses which suggested for positive effect of dynamic stretching: (1) increasing

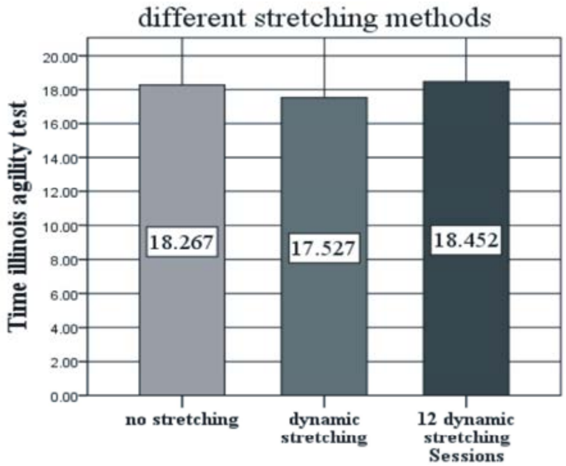

Fig. 2: Agility after no stretching, dynamic stretching and 12 dynamic stretching sessions in handball players. (a) Is a significant difference after dynamic stretching (acute effect) against no stretching and 12 dynamic stretching sessions (chronic effect) and (b) no a significant difference after 12 dynamic stretching sessions (chronic effect) against no stretching.

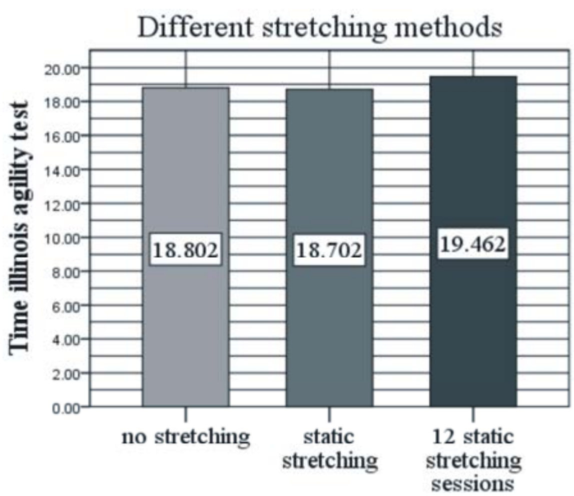

Fig. 3: Agility after no stretching, static stretching and 12 static stretching sessions in handball players. (a) No a significant difference after no stretching against static stretching and (b) is a significant difference after no stretching against 12 static stretching sessions and static stretching (acute effect) against 12 static stretching sessions (chronic effect).

muscle temperature and some level of post-activation potentiation (PAP [22, 23]. PAP may create an opmital environment for athletic performance by increasing phosphorylation of the regulatory myosin light chains, enhancing neuromuscular function, or possibly changing pennation angle [24]. Also, an increase in muscle temperature and muscle blood ?ow as a result of dynamic stretching may induce a more forceful and quicker muscle contraction b increasing the speed of nerve impulses [25] and the force-generating capacity of muscle cells [26]. The findings of the present study are consist with some previous researches which reported that compared to static stretching, dynamic stretching improved agility time records. These similarities are supported by previously explained. In contrast, few studies have observed no detrimental stretching-induced effects on agility performance [27]. 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 [28]. 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). These finding suggest acute dynamic stretching has greater applicability to enhance performance compared to 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.

CONCLUSION

Therefore, it seems that dynamic stretching 1 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. 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.

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