COMPARISON OF TWO DIFFERENT WARM-UPS (STATIC-STRETCHING AND MASSAGE): EFFECTS ON FLEXIBILITY AND EXPLOSIVE POWER

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Abstract
The purpose of this study was to compare the effects of two different warm-up programs consist of Swiss massage and static-stretching on sprint, explosive performance and lower body flexibility in male college athletes. Twenty male college athletes (of three sport disciplines; indoor soccer, volleyball and basketball) with mean± SD, age 25.1± 9.1 years; height 179.2± 6.1 cm; and body mass 66.2± 2.3 kg volunteered to participate in this study and were randomly divided into three groups; a) massage group (MG; n=7), static-stretching group (SSG; n=7), and rest group (RG; n=6). The SSG performed static-stretching movements for warming-up, MG performed Swiss massage for warming-up and CG had passive rest. Vertical jump (VJ), 30-m sprint, agility (T test) and sit & reach tests were assessed before (pre) and after (post) each of interventions. Both the SSG and MG showed significant worsening in VJ, sprint time and T test after each of intervention (P < 0.05). But, rest group showed no significant worsening in VJ, sprint time and T test (P > 0.05). In sit & reach test, both the SSG and MG made significantly improvement (P < 0.05), whereas rest group showed no significant changes (P > 0.05). There were no significant differences between two different warm-ups (static-stretching and massage) for all variables (P > 0.05). Therefore, it is recommended that, coaches and athletes use a massage and stretching movement for warming-up, in many sports requiring to flexibility and range of motion, likewise performing these types of warm up protocols before explosive movements cannot be recommended.

Keywords: *Swiss massage, Static-stretching, Flexibility, Agility, Explosive power*

Introduction

Warm-up prior to physical activity is a well accepted practice believed to reduce the risk of injury and enhance performance (McArdel, Katch, & Katch, 1991). There were various types of pre-event warm-up programs for enhancing performance, such as; static-stretching, massage, dynamic stretching, PNF stretching and or jogging. Athletes generally perform static-stretching after initial jogging during warm-up because it is believed that this type of warm-up is easy and safe (Alter, 1997; Koch et al., 2003). Since the early 1980s, static-stretching has been widely promoted before performing physical activity as a method to prevent injury and improve physical performance (Shrier, 2000). Static-stretching has been shown to significantly reduce leg strength, and high speed motor capacities such as power and vertical jump (Behm & Kibele, 2007; Nelson, Kokkonen, & Eldredoe, 2005). However, it is accepted that pre-event static-stretching can lead to reduce muscle stiffness and increase the range of motion (Hernandez-Reif et al., 2001). But, there were a little information about the warm-up program by using static-stretching and effectiveness on performance. Other technique is Swiss massage. The practice of massage has long been considered an integral part of sport preparation, conditioning and recovery (Caldwell, 2001). Although massage is practiced widely throughout sporting circles, the effects and mechanism associated with massage are unclear or anecdotal (Wiktorsson-Moller et al., 1983; Hemmings, 2001).

Massage involves methodical pressure, friction and rubbing (Hemmings, 2001). Various strokes such as, effleurage, petrissage, tapotement and frictions have been developed from Swiss massage. To our knowledge, very few studies have examined the effects of pre-event massage on performance. There are controversial claims in the sports literature that pre-event massage can increase or decrease performance (Weerapong, Hume, & Kolt, 2005). Wiktorsson-Moller et al., (1983) found that 6-15 minutes of petrissage, with the aim of promoting relaxation and comfort, reduced muscle strength. Goodwin et al., (2007) addressed that a controlled 15 minutes lower limb massage administered prior to warm-up had no significant effect on sprint performance. Research conducted by Hunter et al., (2006) showed that lower limb massage appears to produce a reduction in force during the first contraction of muscles. Two studies found that massage of the hamstring muscle group increased the passive range of motion in hip and lower limb joints (McKechine, Young, & Behm, 2007; Crosman, Chateauvert, & Weisberg, 1984). There is no consensus on the type, style, duration and intensity of warm-up protocols prior to training or competition. Moreover, previous studies only examined the effects of one type of warm-up program such as static-stretching or Swiss massage on performance, and to the best of our knowledge, the information in the area of the comparison of pre-event warm-up program such as static-stretching and Swiss massage is lacking.

Hence, the purpose of the present study was to examine; a) the effects of pre-event lower limb static-stretching on performance (vertical jump, 30-m sprint, agility and sit and reach tests; b) the effects of pre-event lower limb Swiss massage on performance (vertical jump, 30-m sprint, agility and sit and reach tests; and c) the compare between two methods of warm-up programs in male college athletes**.**

Methods

Subjects

Twenty male college athletes (5 volleyball players, 5 basketball players and 10 indoor soccer players [with mean±SD, age 25.1±9.1 years; height 179.2±6.1 cm; and body mass 66.2±2.3 kg]) volunteered to participate in this study. Subjects were informed about the aims, nature, benefits and potential risks the study and provided written informed consent to take apart prior to the investigation. The Institutional Review Board of the University approved the research protocol. After baseline testing, subjects were matched based on vertical jump, agility, sit and reach test and 30-m sprint, and were randomly divided into three group; static-stretching group (SSG; n=7), massage group (MG; n=7), and rest group (RG; n=6).

Study design

The participants received an explanation of the experimental testing and training procedures during a control day about one week before the start of study. During the familiarization session, the participant's initial characteristics (age, height, and body mass) were obtained. After two days of familiarization session, subjects performed sit and reach test, vertical jump, 30-m sprint, and agility T test, respectively, from 9:30 AM to 1:30 PM (pre test). Two days after pre test, each of the subjects applied the following intervention protocols; static-stretching, Swiss massage, and or rest, and immediately performed all tests. All tests for each individual were conducted at approximately the same time of day to eliminate diurnal variations. Subjects instructed to perform 10-min light jogging before each intervention.

Massage Condition

In this study, Swiss massage technique were used in the massage protocol, because of many coaches, athletes and therapists have used this type of massage. The Swiss massage technique included five manipulations; effleurage, friction, petrissage, vibration and tapotment. All manipulations were performed on both left and right lower limb muscles (on the anterior thigh muscles for 5 min and posterior thigh muscles and or calf muscle for 10 min) simultaneously by two professional masseurs using body oil. The amount of oil applied to each subject was sufficient to provide comfort during the vigorous application of massage without irritation of the skin or hair on the leg (Hemmings, 2001; Weerapong, Hume, & Kolt, 2005; Arabaci, 2008).

Static-stretching Condition

In the present study, static-stretching on the target muscles (on the plantar flexor, hamstring, hip flexors, hip extensors, hip adductors and hip abductors) were performed for 20-sec. The subjects first positioned their left lower limb into each of the stretch positions slowly and attentively, and after 10-sec rest, the same stretch was performed on the right lower limb. Subjects performed three sets of 20-sec stretch, and had 10-sec rest interval in between sets.

Rest Condition

In the rest condition, subjects only sat on the chair for 15-min and immediately performed all tests.

Testing

Sit and Reach Test; Subjects sat on the floor with their legs extended. They were asked to keep their lower backs against the wall. They rested their hands on a measurement box while extending their arms and then reached as far as possible. A centimeter scale was printed on the top surface of the box. *Vertical Jump*; This test involves measuring the difference between a person's standing reach and the height recorded from a jump and reach. The difference between the standing height and the jump height is the vertical jump value. Subjects were instructed to perform two-foot vertical jump and peak vertical jump value was recorded in cm. *30-m Sprint*; A 30-m distance was selected to evaluate running performance. The intermediate phases 10, 20 and 30-m were assessed, as well. Subjects were encouraged to sprint as fast as possible. Sprint times were recorded to 0.001 second accuracy by hand-hold chronometer (Joerex, ST4610-2) in the 10, 20 and 30-m points. *Agility T-test*; The T-test (Figure 1) was used to determine speed with directional changes such as forward sprinting, left and right side shuffling, and backpedaling.

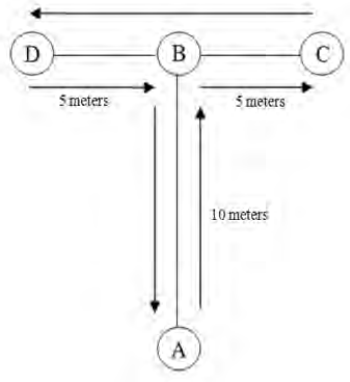

Figure 1. T-test procedure

Statistical analysis; Data are presented as mean ± SD. A two way analysis of variance (ANOVA) with repeated measures was used to analysis the data. The α level was set at $P < 0.05$ for statistical significance. Data analysis was performed using SPSS (version-16.0).

Results

The results of the present study are presented in figure 2. There were significant worsening in VJ, 10, 20 and 30-m sprint time and T-test following static-stretching and Swiss massage ($P < 0.05$). In the sit and reach test, both interventions showed significant improvement from the corresponding pre test ($P < 0.05$). There were no significant changes in the rest group at all test ($P > 0.05$). There were also no significant differences among groups at post test for all variables ($P > 0.05$).

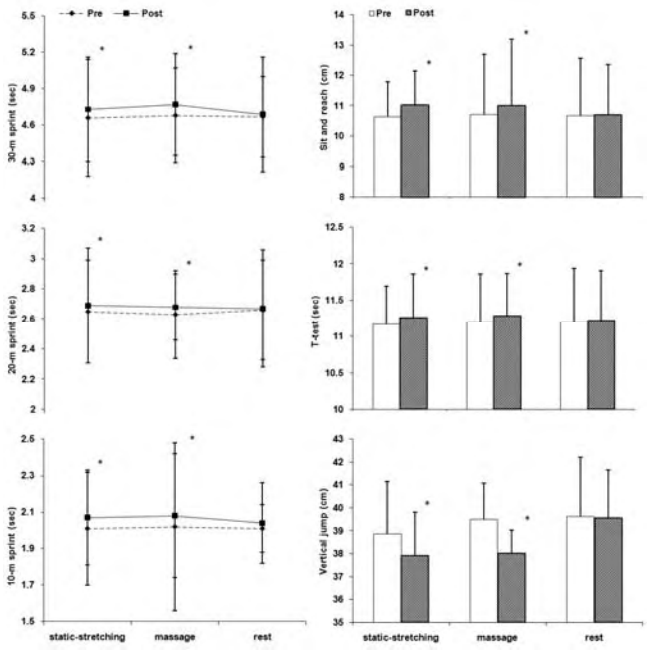

Figure 2. Differences in the 10, 20 and 30-m sprint, vertical jump, T-test and sit and reach test (mean ± SD) * Significant difference from the corresponding pre test ($P < 0.05$).

Discussion

The novel approach of this study was to compare acute effect of pre-event lower limb massage and static stretching on flexibility, vertical jump, 30-m sprint and agility in college athletes' students. The results of this study showed that, both static-stretching and Swiss massage methods led to significant degrades the performance of vertical jump, 10, 20 and 30-m sprint and agility T test. In contrast, static-stretching and massage significantly increased flexibility of the hip joint (sit & reach test). This study is able to demonstrate a significant positive effect of static-stretching and massage on flexibility. This study is in line with those McKechnie, Young, & Behm (2007) who reported significant improvement in the range of motion after Swiss massage. Also, increasing in the flexibility is in line with Arabaci's study. Arabaci (2008) reported that static-stretching improved sit & reach performance. In the present study, we found no significant differences between two types of warm-up protocols. Crosman, Chateauvert, & Weisberg (1984) found that a single massage of the hamstring muscle group increases the passive range of motion in the hip joint. However, Barlow et al., (2004) suggested that a single massage of the hamstring muscle group was not associated with any significant increase in sit & reach performance immediately after treatment in physically active young men. Wiktorsson-Moeller et al., (1983) found that stretching is more effective than massage as a way to increase the range of motion in lower limb joints. It appears that, static-stretching and massage can decrease musculotendinous stiffness and consequently flexibility performance increases (Young & Elliot, 2001). There were mechanisms for improving flexibility induce by static-stretching and massage; massage is an effective to increase lymphatic and venous drainage, squeeze out metabolic waste products, promote deeper relaxation of tissues and stretch muscle fibers, making the tissue interface more mobile (Paine, 2000). These claims would account for the increase in flexibility associated with massage or stretching via reducing stiffness at a fiber level and increasing muscle compliance. The increased hip joint flexibility of this study might also be attributed to increased muscle compliance (Arabaci, 2008; Young & Elliot, 2001). When comparing the effects of static-stretching and massage in the vertical jump, 10, 20 and 30-m sprint and agility T test, no significant differences were observed. Although, both groups (static-stretching and Swiss massage) indicated significant worsening in the vertical jump, sprint and agility T test. The results of the present study are partially consistent with previous studies that examined the use of static-stretching and massage in pre-event performance. Hunter at al. (2006) found a decline in mean force from pre- to post intervention for the massage condition. Wiktorsson- Moller et al., (1983) found that 6–15 minutes of petrissage, with the aim of promoting relaxation and comfort, reduced muscle strength. In contrast, Goodwin et al., (2007) found that a controlled 15 minute lower limb massage administered prior to warm-up had no significant effect on subsequent 30 meter sprint performance. Harmer (1991) examined the effects of 30 minutes of pre-exercise whole body Swiss massage in sprinters. Their results showed that the mean stride frequencies were not significantly different between the massage and control groups. Moreover, McKechine Young, & Behm (2007) found no significant change in the power measures following massage. Mikesky et al., (2002) used a jump test when assessing massage and vertical jump power. Again, their study failed to yield any significant results with the counter movement jump. Also, a number of investigation have illustrated that prior to activity; static-stretching and impair force and jump performance (Behm & Kibele, 2007; Young & Elliot, 2001; Arabaci, 2008). Massage can increase muscle length with affecting performance in power events (Arabaci, 2008). Two hypotheses have been proposed for the stretching induced decrease in force production. First, mechanical factors involving the viscoelastic properties of the muscle may affect the muscle's length-tension relationship. The second involves neural factors, such as decreased muscle activation or altered reflex sensitivity.

When skeletal muscle is lengthened (by static-stretching and Swiss massage), the number of prospective actin/myosin cross-bridges declines, and consequently, power and sprint performance can be worse (McKechnine, Young, & Behm, 2007; Arabaci, 2008; Nelson et al., 2001; Kokkonen, Nelson, & Cornwell, 1998). Therefore, it is plausible to say that a static-stretching and massage induced reduction in muscle stiffness accounted for the decreases in explosive performance and increased flexibility observed here. In addition, it is possible that neural mechanisms also significantly contributed to the decreases in explosive performance and increased flexibility.

In summary, we conclude that static-stretching and Swiss massages are an effective technique for enhancing hip range of motion. Also, these types of warm-up protocols are not effective methods for improving explosive event. According to the present results, static-stretching (20-sec) and long duration massage should not be recommended for warm-ups. Further studies should examine the effectiveness of shorter duration and various types and frequencies of massage manipulations for their utility immediately prior to explosive activities. In addition, more investigations are required in order to determine the best warm-up program.

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USPOREDBA DVAJU RAZLIČITIH "ZAGRIJAVANJA" (STATIČKI-STRETCHING I MASAŽA): UČINCI NA GIBLJIVOST I EKSPLOZIVNU SNAGU

Sažetak

Svrha ovog istraživanja bila je usporedba učinaka dva različita programa "zagrijavanja" sadržanih od Švicarske masaže i statičnog strechinga u sprintu, eksplozivnim akcijama i gibljivosti donjeg dijela tijela kod sportaša na koledžu. Dvadeset muških studenata sportaša (iz tri sportske discipline; mali nogomet, odbojka i košarka) prosječno ±SD, uzrsta 25.1±9.1 g.; visine 179.2±6.1 cm; i tjelesne mase 66.2±2.3 kg dragovoljno je sudjelovalo u u ovom istraživanju i slučajno su raspoređeni u tri skupine: a) grupa masaža (MG, n=7), statički-streching grupa (SSG, n=7) i grupa ostalih 8RG, n=6). SSG su izvodili pokrete statičkog stretchinga za pripremu, MG su izvodili Švicarsku masažu a CG su bili pasivni. Vertikalni skok (VJ), 30-m sprint, agility test i sit & reach testovi su primjenjeni prije (pre) i nakon (post) svake intervencije. Oba, i SSG i MG pokazali su značajno pogoršanje u VJ, sprint time i agility testu nakon svake intervencije (P < 0.05). Ali grupa ostalih (RG) nije pokazala nikakvo značajno pogoršanje (P > 0.05). U sit & reach testu, obje grupe, i SSG i MG pokazale su značajno poboljšanje (P < 0.05), dok grupa ostalih (RG) nije pokazala nikakvu značajniju promjenu (P > 0.05). Nije bilo nikakve značajnije razlike između dvaju različitih zagrijavanja (masaža i statčki stretching) za sve varijable (P > 0.05). Dakle, preporuča se da treneri i sportaši koriste masažu i stretching za pripremu rada u brojnim sportovima koji zahtijevaju gibljivost i opseg pokreta, dok primjena ovih tipova protokola pripreme rada prije eksplozivnih akcija ne može biti preporučena.

Ključne riječi: *Švicarska masaža, statički stretching, gibljivost, agilnost, eksplozivnost*

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