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The effect of different static stretch exercise on range of motion in female university students aged between 18 to 25

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ABSTRACT: Despite the vast volume of research on the effect of static stretch exercise on athletic performance, there is still controversy on this effect. The present study aims at investigating the effect of different static stretch exercise with different timings on range of motion (ROM) and knee extensors muscle strength in female students of Islamic Azad university of Astara. **Methodology**: the population consisted of 15 female students of physical education major chosen on an available population basis with the following average traits (22/6 ± 2/4 years old, 59/4 ± 1/8 kilograms, 160/8 ± 2/02 centimeters). Treatments were given to subjects every 2 to 3 days on a random basis and in 4 groups of exercises including 4 sets of 15 seconds, 4 sets of 30 seconds, 16 sets of 15 seconds and 16 sets of 30 seconds with static stretch exercise. The control condition on the other hand, consisted of 8 minutes rest. Both knee extensors and ROM were measured before and after the treatment or rest. **Results**: the results showed that the ROM was significantly increased in all static stretch exercises. It was further showed no significance difference between different exercise protocols in increasing ROM. Any of stretch exercises showed a significance decrease in quadriceps muscle strength, Neither. Never the less in control groups quadriceps muscle strength was significantly decreased (P< 0.05).**Conclusions**: short term stretch exercise protocols can increase the range of motion with no negative effects on knee extensors' strength.

***Keywords*:** Flexibility, Stretch Exercise, ROM, University Students.

INTRODUCTION

Athletes usually do static stretching exercise warm-up in the hope of improved athletic performance as well as avoiding the injuries. Despite the great volume of research on the effect of stretching exercise on improved athletic performance, there's still a lack of evidence on how it effects the other. Considering the presumption that increased flexibility entails better athletic performance and better prevention of injuries, stretching exercises have been included in both warm-up exercises and all sport events. On the other hand it has been shown previously that pre-event static stretch exercise in warm up has negative effect on strength, power and speed (6). While Fawles et al. (2000) as an instance, showed a significant reduction in Ankle flexion muscle strength after a 30 minute static stretch (5), Alison et al. (2006) didn't identify any significance reduction in leg muscle strength as well as in vertical jump in professional basketball players (1). Three exercise protocols of 2, 3 and 8 minutes were carried out on leg muscles by Erice et al. (2008). They showed that the peak torque of muscle as well as muscle strength decreases after each of the three stretching (3). Erocol et al. (2007) also concluded from a descriptive study that different static exercise protocols increased the motion range in hip and ankle joints significantly (4). These contradictory results between common beliefs and new research studies has caused bewilderment among athletes and physical education coaches and they wonder whether it is necessary to stretch and warm up before the athletic event. Nevertheless, the evidence proves that negative results of static stretch exercises have been shown in studies where the timing of exercises exceeded the recommended standard timing (4). Therefore in the present study, different timings of static exercises were investigated on motion range of hip joint and on the motion strength of knee extensors.

MATERIALS AND METHODS

METHODOLOGY

The society of the study consisted of 15 female physical education students at Islamic Azad University of Astara who participated in the study voluntarily. The standard deviation ± average of age, height, weight, and body mass index (BMI) were 22.6 ± 2.4 year old, 160.8 ± 2.02 cm, 59.4 ±1.8 kg, and 22.9±1.05 kg/m², respectively. The society also participated in a briefing session 2 days before the start of the test to carry out their first measurements and to categorize them in experiment and control groups. They were also informed about the day, timing and methodology of doing the exercises correctly. Later on all participants were randomly tested every 2 or 3 days in all stretching exercise conditions including 4 sets of 15 seconds, 4 sets of 30 seconds, 16 sets of 15 seconds and 16 sets of 30 seconds as well as 8 minute rest. The stretch exercise consisted mostly of exercise for quadriceps muscles. It was further recommended to subjects to do the stretch with no jumps or extra movements and when they would feel enough stretch, keep that stable and when they feel pressure, they would slow down the stretch a bit until they reach a good status. Before starting the exercise, subjects were asked to warm up their leg muscles on a cycloergometer (model Monark 839) with intensity of 50 watts for five minutes. Afterwards, motion range of hip joint and the motion strength of knee extensors were measured. For measuring the motion range of hip joint, straight leg rising method (SLR) was applied for the subjects (4) which is known as the most common testing techniques for measuring the motion range of hip joint. A goniometer was used and the best measure was recorded after 3 times. A dynamometer was also used for measuring the strengths of knee extensors and the best measure was recorded after 3 times with 30 seconds rest between each. After the first measurement, the results were used as the pre-test and subjects would do the 4 groups of exercises or would take an 8 minute rest depending on their placement in each exercise category. Later on measuring the motion range of hip joint and strength of knee extensors were carried out as post-test.

For analyzing the data after assuring their naturalness, T student and ANOVA (analysis of variance) was carried out.

RESEARCH FINDINGS

The findings of pre-test and post-test of the study in all 4 categories of exercise as well as rest are shown in table 1. As could be seen in table 1, after all 4 categories of exercises, the motion range of hip joint was increased significantly which are explained as follows:

in category of 4 sets of 15 seconds (t8= -3/455 ; P= 0/009)
in category of 4 sets of 30 seconds (t10= 4/894) ; P= 0/001)
in category of 16 sets of 15 seconds (t10= 7/147 ; P= 0/000)
in category of 16 sets of 30 seconds (t10= 4/889 ; P= 0/001)

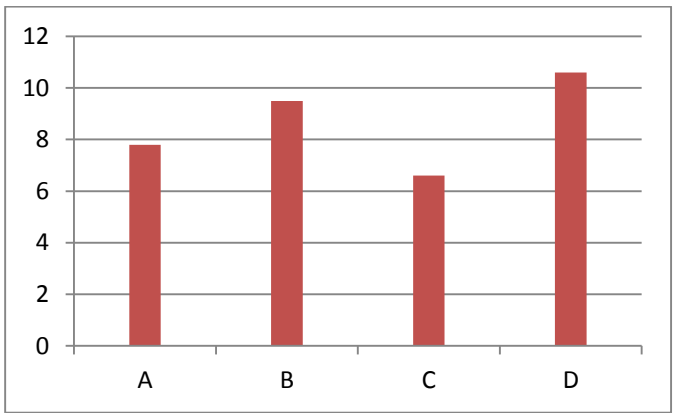
On the contrary, there was not a significant effect of static stretch on ROM muscle in control group. While none of the stretch exercises did not show a significant effect on strength of knee extensors, the latter was reduced significantly in control group (t 10= 2/213 ; P= 0/049). Increase percentage of motion range of thigh is shown in table 1 which shows the increase in groups of 4 sets of 15 seconds, 4 sets of 30 seconds, 16 sets of 15 seconds and 16 sets of 30 seconds equal to 7/8 , 9/5 , 6/6 and 10/6 percent respectively. Furthermore, variance analysis didn't show a significant change in exercise categories (F3& 41 = 0/675; P= 0/584).

Table 1. pre-test and post-test of the study in all 4 categories of exercise protocols

Dependant variable / independant variable	Quadriceps strength (kilograms)		Range of motion(degrees)	
	Pre-test	post-test	Pre-test	post-test
4 sets of 15 seconds static stretch	7.5± 4.1	7.4 ± 4.5	95.2 ± 13.6	*102.6±14.6
4 sets of 30 seconds static stretch	6.3± 2.5	5.8 ± 1.5	94.6 ± 15	*105.1 ± 13.1
16 sets of 15 seconds static stretch	7.4 ± 4.1	6.1 ± 1.8	90.5 ± 9.4	*102.2 ± 11.2
16 sets of 30 seconds static stretch	7.2 ± 3.5	6.9 ± 2.8	93.5 ± 15.4	*105.6 ± 12.1
480 seconds rest	8.3 ± 5.6	*7.1 ± 4	92.5 ± 15.8	93.4 ± 15.2

* significant increase compared with pre-test (P < 0/01)
** significant decrease compared with pre-test (P < 0/05)

The result of the motion range of thigh joint is shown in Picture 1 below.



Picture 1. increase percentage of motion range of thigh joint in pretest and both test in experiment groups A (4 sets of 15 seconds) B (4 sets of 30 seconds) C (16 sets of 15 seconds) D (16 sets of 30 seconds)

RESULTS AND DISCUSSION

Short term effect of stretch exercise on motion range and muscle strength

The results of the present study shows that stretch exercise does not cause significant reduction in quadriceps muscle strength. In another word, by practicing the static stretch protocols, the motion range of joint increased and also any negative effect was noticed in muscle strength. The result of the present study was not in harmony with other related research in which they reported that static stretch entailed reduction of muscle strength. These research include that of Erik's (2008), Rubini (2007), Ercole (2007) and Unick (2005) (13, 12, 4, 3). Erik (2008) investigated the effect of 2,4 and 8 minute stretch exercises on ankle flexion muscle. He used control groups and stated that in these groups ankle flexion muscle strength was not reduced compared with that of the experiment group. Nevertheless in both groups strength reduction was noticed (3). Fowles et al. (2000) experimented the short term effect of static stretch on muscle strength and showed that 30 minutes of stretch, reduces ankle flexion muscle strength up to 28%. Although we should be aware that a maximum timing for stretch exercise has been applied in Fowel's study (30 minutes) (5). Cramer chose less timing for stretch exercise in ankle flexion muscle and observed a 10% strength reduction for 20 minutes exercise, 7% strength reduction for 10 minutes exercise and 3% after 5 minutes warm-up and 1 to 4 minutes exercise. The later was not significant (2). Fowels (2000), Weir (2005) and Herda (2009) stated a significant reduction in strength after 30, 20 and 10 minutes stretch exercise which was shown in a linear pattern in such a way that the most reduction was observed to be for 30 minute protocol (28%) and later for 20 minute protocol (10%) and finally for 10 minute protocol (7%). In Fowels' study strength reduction of ankle flexions after 8 minute stretch exercise was equal to 6% which was not considered to be significant (5,6,15). The stretch threshold could be between 8 and 10 which does not make a significant or insignificant difference compared with flexion strength of control group without exercise. In addition it is not clear enough that these tentative results are related to the properties of muscles or the type of stretch (e.g. static, dynamic, PNF). Furthermore it cannot be concluded that the result is true about the professional athletes (4). The effect of stretch exercises are divided into two mechanisms of neurophysiologic and biomechanical (16, 12, 3). Neural factors include muscel contraction deterrence , increased muscle compliance (enlarging ability) (5) and reduced sensitivity of Golgi tendon organ (4). Biomechanical factors on the other hand, consist of viscoelastic properties of tendon-muscle (2,3,4).

Although Wier (2005) didn't observe any change in activity of ankle flexion muscle with a 10 minute stretch exercise (15), Herda (2000) showed that longer stretch exercise can reduce the efficient activity of ankle flexion and extensor digitorum longus (6). The result of both Erik's (2008) and Herda's (2000) studies states that less stretch for shorter time probably does not reduce ankle flexion muscles (3,6). In contrast, Kramer (2007) stated that in bigger muscle groups such as extensor dogitorum, the muscle strength was reduced after 8 minute stretch (6). Therefore while this reduction might refer to the properties of the muscle or proximal muscles, distal muscles may need more time for reduction of activity (2). The effect of stretch exercises on motion range of joint could be of two types of neurophysiologic and biomechanical (3, 12, 16). Magnusson (2002) and Klus wimen (1997) suggest that the increase of motion range of joints in shorter period stretch (about 2 minutes) can be due to increased tolerance of stretch but increase of motion range in joint during longer period stretch (about 7/5 minutes) can be due to decreased muscle stiffness (8,9). In the current study, different static position stretch protocols did not show any significant effect on knee extensors' strength and did not cause a significant decrease. Nevertheless a significant reduction in knee extensors' strength was observed in control group. It is probable that having no exercises and cooling down of body

has direct effect on neural- muscular system and causes reduction in knee extensors' strength. In addition, since no significant difference between different timing protocols was observed, it is concluded that shorter period stretch could be more efficient.

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