

# Acute effects of dynamic and static stretching on muscle strength, power and endurance in untrained male subjects

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**ABSTRACT: Purpose:** On this basis, the purpose of this study was to compare the acute effects of dynamic and static stretching on upper body maximal muscle strength, power and endurance in untrained male subjects. **Methods:** 12 untrained college-aged male (age:  $23.17 \pm 4.06$  years; height:  $175.17 \pm 5.55$  cm; weight:  $67.33 \pm 8.26$  Kg; body fat:  $16.67 \pm 1.82$  percent; BMI:  $21.78 \pm 2.13$  Kg.m<sup>-2</sup>) in three different position of dynamic stretching, static stretching and non-stretching during three consecutive weeks by using strength, endurance and power tests in counterbalance method were be investigated. In each week three session of test with 48 hours intervals between sessions were performed. Data with using of repeated measures and post hoc test with significant level of ( $P < 0.05$ ) were analyzed. **Results:** The results of the present study indicated that performing dynamic and static stretching during pre-exercise period in comparison to non-stretching method significantly improved upper body performance (muscular strength, endurance and power) in untrained subjects ( $P < 0.05$ ). Also, dynamic stretching in comparison to static stretching significantly increased three above mentioned factors ( $P < 0.05$ ). **Discussion:** The findings of current study showed that performing pre-exercise session dynamic stretching in comparison to static stretching significantly improved performance in these subjects. Over all, this study suggested that performing stretching in this period can improve performance during an exercise bout. Also advises untrained individuals who want to begin resistance exercises to use dynamic stretching in warm up period before exercise bout.

**Keywords:** Dynamic stretching, Static stretching, upper body performance, untrained me.

## INTRODUCTION

Massive developments in the different fields of sports, especially progressive increasing in sports sciences research has caused to specialize in sports and trainers to more researchers about physical activity factors in athletes and nonathletes persons. On the other hand, without investigation on basic of scientific researchs training won't lead to desired results. One of the main and effective issues in exercise performance efficiency during an exercise session is that how to start exercise session and what is to be done before initiation exercise session. One of the major factors that effects on the performance during a training session is how to begin the training session and acts must be done during time pre-exercise session. Stretching is an important part of the warm-up before a bout of exercise and physical activity that used to improve maximum muscle performance, reduce muscle damage, reduced muscle fatigue and increased joints flexibility [Molacek 2010]. In ACSM's report emphasised that before performing maximal muscle activity stretching must be done [ACSM's 2005].

While one of the most common, comfortable and safe method of stretching, is static stretching, that usually used by people who participate in sports activities [Gray 2002], some studies show that performing static stretching before acute exercise decreases the upper body performance. for example, Franco et al. (2008) examined The effects of static stretching and PNF on the upper body muscular endurance, and founded that static stretching reduced the number of repetitions (muscular endurance) of the bench press. Of course, some studies after performing static stretching during the warm-up before exercise session did not report any significant effects on athletic performance. For example, Roberto et al. (2011) founded that performing static stretching before exercise bout did not have significant effect on upper body muscular endurance. This claim that static stretching has negative or no effect on physical activities performance, attributed to some mechanical and neurological factors, but in contrast some researchers after static stretching have reported improvements in performance [Murphy 2008, McMillian 2006]. Another method of stretching that has been investigated in studies is dynamic stretching. This type method due to mechanisms such as increasing muscle temperature, increasing nerve impulses, and the similar pattern of movements with sport activities which thereby due to enhancing the coordination rather than static stretching has attracted more attention among fitness trainers, athletes as well as non-athletes who want to start their physical activity, especially weight training [Kortney 2010]. However, few studies investigated the acute effects of this type of stretching on maximum muscle performance (muscular strength, endurance) and reported contradictory results.

Many of researchers, who studied the effects of dynamic stretching on athletic performance, Have concluded that dynamic stretching is more efficient than static stretching [McMillian 2006, Murphy 2008, Yamaguchi 2006]. For instance, McMillian et al. (2006) investigated the effects of dynamic and static stretching on muscle strength in 14 females and 16 males; and founded that versus static stretching; dynamic stretching significantly improved the performance of the high jump.

Also, Murphy et al. (2008) and Yamaguchi et al. (2006) after dynamic stretching, in comparison of static and non-stretching methods significant increase in muscle strength and power performance reported. In contrast to these studies, some researchers didn't observe significant effects of dynamic stretching on maximum performance. For example, Torres et al. (2008) observed that performing the dynamic stretching before power exercise, did not significant effects on upper body maximal muscular strength.

Because of contradictory results in the above mentioned studies, and exist of little researchs that has been done to compare the acute effects of dynamic and static stretching on the upper body maximal muscular performance in untrained men, and in order to provide clear information about this issue, The purpose of this study was to compare the acute effects and efficiency of dynamic and static stretching on maximal upper body muscular strength, power and endurance in untrained men.

## MATERIALS AND METHODS

### METHODS

12 untrained college-age male (age: 23.17±4.06 years; hieght:175.17±5.55 cm; weight: 67.33±8.26 Kg; body fat: 16.67±1.82 percent; BMI: 21.78±2.13 Kg.m<sup>-2</sup>) with no history of diseases and smoking who had previous experience in weight training, but from at least one year before of the present study did not have participated in weight training, volunteered to participate in this study; then during three weeks they were studied. After the subjects announced for this study and before the start of protocol, in a session, the steps and procedure of protocol were explained to them. Then they completed consent form and health questionnaire, and finally anthropometric measurements such as age, height, weight, body fat percentage and body mass index were measured (Table 1).

In the three sessions of the first week, at first using counterbalance manner and with one of three following methods performed stretching; non-stretching method (5 minutes jogging), Warm up with a static stretch (three sets, keeping stretching for 25 seconds in each sets during 10 seconds intervals between sets), and worm up with dynamic stretching (three sets with 10 repetitions and during 10 seconds intervals between sets), then they performed the test of muscular power (Throwing medicine ball). The method of study during second and third weeks were similar to the first, except that in them after warming up the muscle strength and muscular endurance tests carried out by subjects (Torres 2008).

Table 1. Testing schedule

Group	First session	Second session	Third session
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1	NS	SS	DS
2	SS	DS	NS
3	DS	NS	SS

For static and dynamic stretching, which were similar in terms of time ( $(5 \times [3 \times 25 + 2 \times 10] = 90) = 7:55) + 4 \times 30 = 10$ ), five movements were intended that included; deltoid, rhomboid and biceps muscles were stretched in each program. Therefore, the sessions with static or dynamic stretching started (five minutes jogging then 10 minutes dynamic or static stretching); were being lasted for 15 minutes. The main test initiated two minutes after warm-up. All meetings were held in a fixed time period (8 am to 12 pm). All the warm-up and implementation of the tests was carried out under the supervision of examiners.

**Statistical Measurements**

The findings of present study were described using descriptive statistics that included tables, charts; mean and standard deviation. Also for data analyzing Inferential statistical that included analysis of variance with repeated measures and Sydak post hoc test were used. The results of current study were investigated in ( $P < 0.05$ ) Significant levels. SPSS16 for analysis data and Excel software for drawing diagrams and tables were used.

**RESULTS AND DISCUSSION**

**RESULTS**

The results of present study showed that in comparison to non-stretching, performing dynamic and static stretching in pre-exercise warm-up period significantly increased muscular power, strength and endurance compared with in untrained men. Also, dynamic stretching rather than static stretching significantly increased each of three above mentioned factors. Table 2 show, the results of this study schematically.

Table 2. Results of study

	non-stretching muscular power	muscular strength	muscular endurance	dynamic stretching muscular power	muscular strength	muscular endurance
dynamic stretching	0.002*	0.003*	0.002*			
static stretching	0.018*	0.032*	0.047*	0.028*	0.013*	0.025*

(\*): Significant different ( $p \leq 0.05$ )

**DISCUSSION**

Comparison the different methods of training in order to select the most effective stretching method due to the variety of specific training provides useful information in this field for coaches, fitness experts that they could provide the groundwork for improving athletic performance. according to the findings of previous studies stretching before exercise begins increased range of motion when performing sports skills, increase the amount of swing in motion, muscular relaxation, prevention of sports injuries, impact on maximum muscular strength, endurance, strength, speed, agility, etc. in trained and untrained men [Molacek 2010].

The results of this study indicated that performing dynamic and static stretching in pre-exercise period significantly increased upper body muscular. In the other hands, dynamic stretching rather than static stretching significantly improved performance of throwing the medicine ball. Few studies have been done to compare the effect of stretching on muscular power of the upper body.

The only study that investigated the effect of stretching on muscular power using of medicine ball is McMillian et al study (2006), they reported that dynamic stretching rather than static stretching and the control group (non-stretching) had a significant effect on agility (test T) and muscular strength (throwing the medicine ball). Also, static stretching in comparison non-stretching method did not improve the records of medical ball throwing. The contradiction results about effects of static stretching on performance between the present study and McMillian et al. probably was due to differences in measurement protocols. Because in their study the whole-body muscle strength was measured (throwing the ball without keeping the upper body in fixed position, and with help of the whole body's force). While, in present study only upper body muscles were participated in throwing the ball. On the other hands, the differences among subjects, type of stretching, psychological factors also can contribute to the antithetical results.

Few studies have investigated the effects of stretching in the warm-up period before a training session on muscular strength, endurance and power in the upper during a workout. Most of these studies, examined the effects of stretching on flexibility and reduction of damage [Andersen 2005, Little 2006, Marek 2005]. Performing stretching

during the warm-up period before main session is common among participants in weight training. Its aims are to improve performance and prevent damage.

One of the common methods to do stretching during warm up period before the main training session is static stretching. That includes a slow movement to the end of its motion range, before the onset of the pain [Vetter 2007]. It is common for several reasons; first, it can be done individually and without need to assistance, secondly increased range of motion in the joint [Marek 2005]. Because it is thought that with maximize the range of motion and by increasing coordination sport performance will be improved [Safran 1989].

In general, because it is thought that static stretching increases the dilation of tendons and muscle fibers, as a way to prevent creation damage in muscle-tendon unit was supported, this is thought to increase the force transmission capacity [Shrier 2004]. However, some studies showed that performing static stretching in warm-up period before acute exercise reduced exercise performance [Roberto 2011, Franco 2008, Nelson 2005, Power 2004].

Monteiro et al. (2009) reported that performing static stretching reduced maximal strength in lower body of females. Also, Nelson et al. (2005) found that performing static stretching before resistance exercise bout reduced sustainability of leg press (lower muscular endurance). Franko et al. (2008) investigated the effects of static and PNF stretching on upper body muscular endurance, and reported that static stretching reduced the sustainability of bench press repetitions (the upper body muscular endurance) in subjects. Rodrigo et al. in leg press 1RM and Halt et al. in high jump test (sargent test) similar results reported. Of course, in some studies reported that static stretching didn't have any significant effects on performance. Roberto et al. (2011) reported that performing static stretching in pre-exercise warm up before the training session didn't have significant effects on upper and lower muscular endurance.

Nowadays, according to the evidence on the positive effects of dynamic stretching on physical performance, coaches advise athletes and novices instead of static stretching perform dynamic stretching [Baechle 2008]. Recent reports indicate that performing dynamic stretching before exercise by increasing the range of motion and body temperature improve performance, it also increases blood flow to active muscles, as a result, lead to faster nerve impulse transmission [Kortney 2010]. As respects dynamic stretching simulates movement patterns that are used in an exercise, probably by providing an opportunity to practice specific sports skills increases coordination [Little 2006].

This claim that static stretching does not affect performance, or reduced it have been attributed mechanical and neurological factors. In terms of mechanical, static stretching leads to an increase in dilation of the tendon-muscle units. When the tendon-muscle unit stretches, contractile elements (myofibers) must be contract more severe to improve the performance, and maximum torque is reduced and process of force increasing be slower [Evetovich 2003].

From neurological aspect, performing static stretching before exercise session may reduce the activity of motor units [Evetovich 2003, Beedle 2008]; And adversely affects on the capacity of force generation. In contrast, some researchers reported improvement in the performance after static stretching. For example, McMillian et al. (2006) reported that performing static stretching before power exercise activities lead to improvement of high jump performance. Also, Murphy et al (2008) reported similar results. Most scholars who have studied the effect of dynamic stretching on sport performance, concluded that dynamic stretching rather than static stretching have more positive effects [McMillian 2006, Murphy 2008, Yamaguchi 2006].

Finally, our finding support the idea that performing stretching during pre-exercise warm-up period improves the performance of upper muscular strength, endurance and power in untrained men during the next workout. Also, the results showed that using of dynamic stretching during this period is preferred to static stretching, therefore can significantly improve upper body performance in each of these three factors.

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