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Acute Effects of Dynamic versus Static Stretching on Aneorobic Power and Muscle Damage of Wrestlers

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KEYWORDS Wingate. Fatigue. Peak Power. Creatine Kinase. Relative Power

ABSTRACT The purpose of the presentstudy isto investigate the acute effects of static and dynamic stretching protocols (3 minutes stretching) on a maximal anaerobic Wingate Test (WT) of wrestlers. Fifteen male wrestlers (age, 23.2± 2.6years; body mass, 79.2± 10.7 kg) volunteered to participate in the study. Peak power, mean power, and average powers of the subjects were assessed during the Wingate test (WT) after static stretching and dynamic stretching. CK (creatine kinase) values were obtained before and after ach stretching protocols. Two WT were performed after stretching. Data analysis included paired t-tests. It was found that dynamic stretching caused more power deficits than static stretching and CK (creatine kinase) values of wrestlers increased more with dynamic stretching. Dynamic stretching caused significant decrease in power ascompared to static stretching, considered to be because of different duration of stretchingand continuous dynamic activity may have caused exercise induced muscle damage.

INTRODUCTION

The impact of muscular performance and its enhancement have been of interest to those who examinestretching and its effects on muscles. Stretching is frequently performed before exercise (Franklin et al. 2000) and athletic events (Beaulieu 1981; Holcomb 2000). Recent studies have reported that stretching before exercise or performance events in fact reduces isometric and dynamic muscle strength (Avela 1999; Behm 2001; Fowles 2000). Consequently, this phenomenon has been defined as stretching induced force deficit. It has been suggested thatprolonged stretching is associated with a reduction in neural input into the muscles being stretched, resulting into sharp decline in performance (Cramer 2004).

In addition, regarding sports and athletic performance, dynamic muscle events are more frequently experienced. The Wingate test (WT) is a usual dynamic test used to measure an athlete's anaerobic performance (Ramirez 2007). It was suggested that the type of athletic event, the number of repetitions, period of each repetition, muscle concerned in stretching sessions, and the type of stretching may be other factors elucidatingcontradictoryresultsoffered in previous studies (Franco 2008). Many studies investigated stretching protocols under 2 minutes of total stretching time (Cramer et al. 2007; Fletcher and Anness 2007; Franco et al. 2008; Ogura et al. 2007; Bruno et al.2012; O'Connor et al. 2006; Yamaguchi 2005). Previous studies indicate that dynamic stretching acutely improves explosive performance, and dynamic stretching is being incorporated into warm-up protocols prior to sports activities that require explosive performance. It was also reported that explosive performance might become impaired as the volume of dynamic stretching increases (Yamaguchi et al. 2014). Prior studies have also indicated that ballistic and PNF stretching, like static stretching, acutely harm various performances. The most favorable protocol for dynamic stretching to increase performance, still, has not been clarified (Yamaguchi and Ishi 2011). In fact, it is vital to find out the effects of common stretching techniques in sports that require high anaerobic power. Wrestlers usually stretch their muscles over two minutes and their stretching strategies vary as far as type of the stretching. They mostly use dynamic and static stretching in their warm ups before the competitions. Wrestlingis a combat sports that requires extensive anaerobic power and it is important to investigate the effects of two common stretching techniques which is Static vs. Dynamic used on anaerobic power of thewrestlers.

Objectives of the Study

The purpose of the present research is to investigate and compare the acute effects of two different stretching protocols for 3 minutes on a maximal anaerobic WT of wrestlers. Also, creatine kinase (CK) activity of the wrestlers were assessed to level if muscle damage if it is accompanied with fatigue index (FI). It was hypothesized any dynamic stretching exercise would lead to a more decline in power of elite wrestlersright through the anaerobic cycle performance.

MATERIAL AND METHODS

Participants and Experimental Design

Fifteen male wrestlers between the age of 23.2± 2.6 years; body mass, 79.2± 10.7 kg; and height, 17.2 ± 1.1 cm volunteered to participate in the study. There were written and oral consent from each participant which was obtained from them prior their participating in the study. The subjects were informed of any possible risks during the experiment. The Ethics Committee of the SeljukUniversity approved the experimental protocol. The investigation was intended to examinethe acute effects of two different stretching protocols on muscle power performance during a dynamic activity. The effects of these two stretching types were assessed during three separate investigations. Thus, the variables peak power, mean power, and average power, were assessed during the Wingate test after static stretching and dynamic stretching. CK values were obtained before and after ach stretching protocols and evaluated.

Procedures

Wingate anaerobic testwas performed on three non-consecutive days with a rest period of 5days between tests. Two WT were performed after stretching conditions. Each WT was performed on a cycle ergometer (MonarkErgomedic 828E, Sweden). The hamstrings, the quadriceps, and the calf muscles were stretched. Two stretching protocols were: 1) a static stretching (SS) exercise consisting of 6 sets of 30 seconds;2) a dynamic stretching (DS) exercise consisting of 6 sets of five slow repetitions followed by 10 fast repetitions completed as fast as possible. The same stretching protocols that were used to measure lower body power were used to measure power parameters of arm on Wingate protocol. This took another 2 days with the rest period of 5 days between tests. The biceps, triceps, and shoulders were stretched.

CK Measurement

A sample of 5ml blood was taken from the right vein, before and after each stretching protocol. After taking the blood, it wasinstantly frozen for subsequent analyses. A VITROS's DT60 II dry slide clinical chemistry system (Ortho-Clinical Diagnostics, Amersham, UK) was used to determine serum CK concentrations. CreatineKinase analysis were made and recorded as (CK) (U/L).

Statistical Analyses

Data analysis included paired t-tests. Statistical analysis of the findings was evaluated by a computer program (SPSS 22.0 package), and the average and standard deviation of all parameters were calculated. An alpha level of pd”0.05 was considered statistically significant for all comparisons.

RESULTS

On the basis of the results obtained from thestudy, it was investigated that peak power of leg (839.5±108.2) and arm (602.7±110.5) of wrestlers were significantly higher in static stretchingthan dynamic stretching (leg; 801.1±105.5, arm; 502.8±116.3) condition (leg; p=0.00, arm; p=0.01).Relative peak power and average power were not significantly different between two stretching conditions for both leg (static; 10.6± 1.2, dynamic; 10.8 1.2) and arm (static; 7.6-±1.2, dynamic; 6.7±1.1) except average arm power of wrestlers were found to be significantly higher in static condition than dynamic stretching condition (p = 0.09) (Table1, Figs. 1, 2 and 3).

In addition, there were no significant differences between groups in creatine kinase activity (static; 120.5±44.2, dynamic; 136.0±33.4) and fatigue index (55.2 for both) at baseline measurements. However, post-stretching results indicated that creatine kinase activity (static; 165.6±63.6, dynamic; 198.3±32.1) and fatigue index (static; 65.8, dynamic; 71.3) was higher for dynamic stretching compared to static stretching (Table 2, Figs. 4 and 5).

Table 1: Variations between static vs. dynamic stretching anaerobic power parameters

Variable	*Condition*	*Leg*		*Arm*	
		Mean± SD	*P*	*Mean± SD*	*P*
Peak-Power (W)	Static	839.5 ± 108.2*	0.00	602.7± 110.5*	0.01
	Dynamic	801.1 ± 105.5		502.8± 116.3	
Relative Peak Power (W/kg)	Static	10.6 ± 1.2	0.66	7.6-± 1.2	0.09
	Dynamic	10.8 ± 1.2		6.7± 1.1	
Average Power (W)	Static	608.8 ± 80.8	0.25	412.7± 70.3*	0.00
	Dynamic	593.1 ± 75.5		337.1± 67.5	

* = significantly different than other condition.

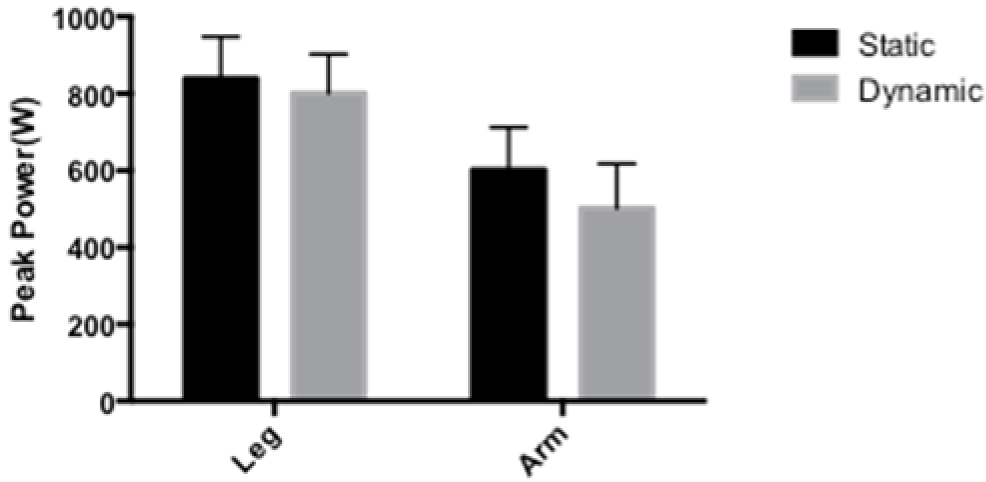

Fig. 1. Relative power of leg and arm before and after dynamic and static stretching

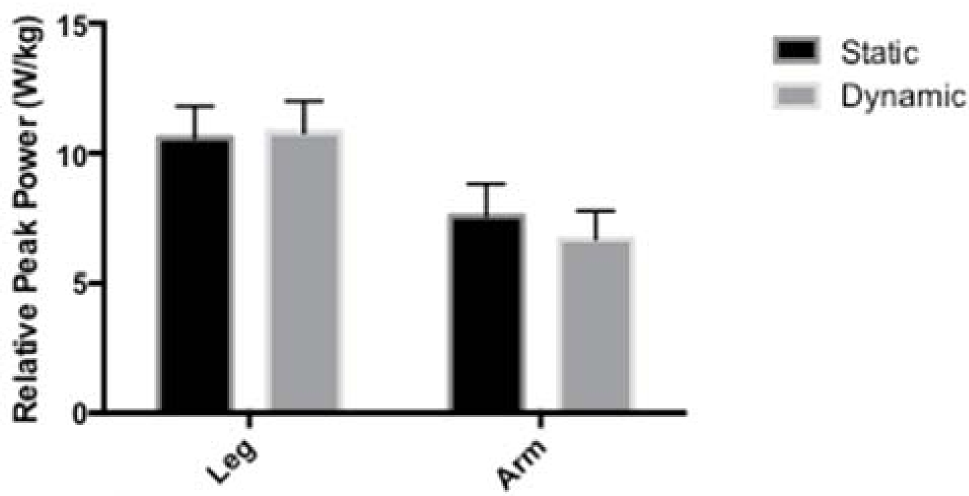

Fig. 2. Relative power of leg and arm before and after dynamic and static stretching

Table 2: Creatine Kinase activity and Fatigue indexes between the stretching protocols

	Condition	*Pre*		*Post*	
		Mean± SD	*P*	*Mean± SD*	*P*
Creatine Kinase (U/L)	Static	120.5± 44.2	0.19	165.6± 63.6	0.04*
	Dynamic	136.0± 33.4		198.3± 32.1	
Fatigue index (%)	Static	55.2	0.85	65.8	0.10
	Dynamic	55.2		71.3	

* = significantly different than other condition.

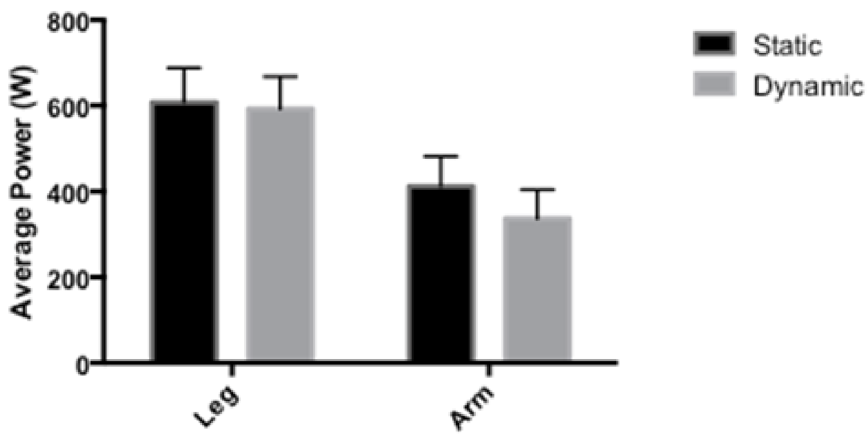

Fig. 3. Average power of leg and arm before and after dynamic and static stretching

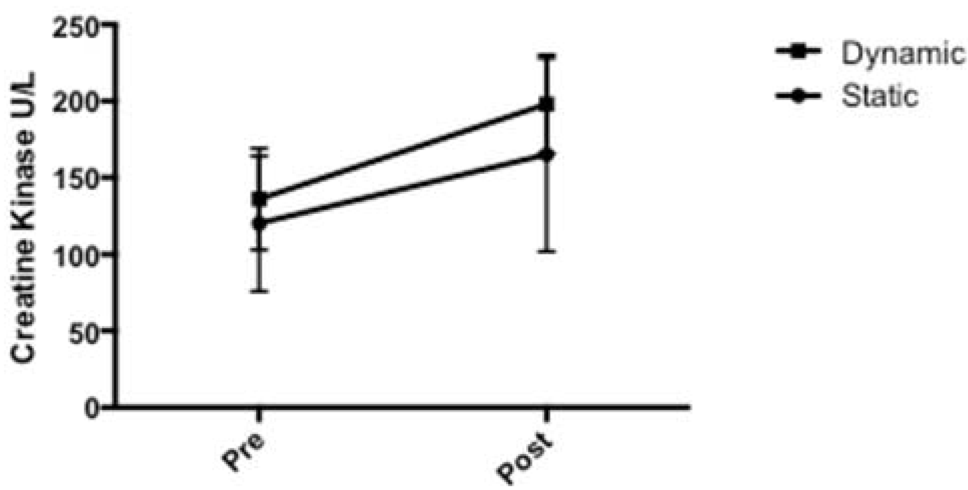

Fig.4. Creatine Kinase activity before and after treatment

DISCUSSION

The duration of stretching is a one of the major variables in stretching induced deficits. It has been reported that comparatively longer stretching protocols typically producing lower performance results (Behm and Chaouachi 2011). Moreover, the quantity of repetitions, muscle

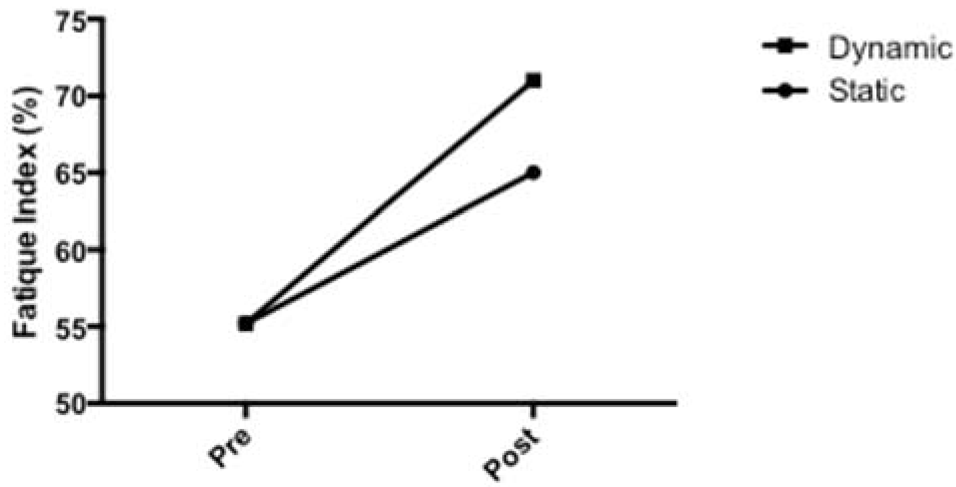

Fig. 5. Fatique index before and after static and dynamic stretching

involved in stretching and the nature of stretching plays a critical role in studies that obtained contradictory result (Franco et al. 2008). The present study aims to investigate and compare the acute effects of static and dynamic stretching protocols (3 minutes duration) on a maximal anaerobic power and creatine kinase activity of wrestlers of wrestlers.

Several studies have investigated the effects of stretching protocols on single movement power tests. Some studies have demonstratedthat thestatic stretching before explosive exercise may weaken power production (Cramer et al. 2007), and sprinting performance (Fletcher and Anness 2007) while dynamic stretching may advance power increase and vertical jump performance (Kokkonen et al.1998). Thus, many studies recommended that static stretching integrated in pre-competition warm-up routines should be replaced by dynamic stretching since SS (static stretching) might lessen muscular power production (Young and Behm 2003; Wallmann et al. 2005).

In the present study, it is found that dynamic stretching caused more power deficits than static stretching and CK values of wrestlers increased more with dynamic stretching. Previous studies used different protocols and made comparisons. Franco et al. (2008) found depressing effects with one set of 40 seconds of static stretching and PNF stretching on athletic performance. Ogura et al. (2007) compared two static stretching durations of 30 and 60 seconds respectively on the quadriceps. While the 30 seconds of stretching did not influence muscular performance; conversely, 60 seconds of stretching caused a significant reduction in strength. Bruno et al. (2012) also investigated the effects of three different stretching methods with the duration of 90 seconds on Wingate test performance and it was concluded that stretching decreased performance by lowering peak power, whereas increased the total power. They found that static and PNF stretching had the most negative influence on WT performance. Ramirez et al. (2007) compared stretching with a conventional warm up on WT performance and found a decrease in peak power and mean power (MP). On the other hand, O'Connor et al. (2006) evaluated the effects of stretching on an adapted Wingate test for 10 seconds and, mean power and peak power of the subjects were increased. These results are not in agreement with the findings from Ramirez et al. (2007) study. Possibly, the use of a particular warm-up before performing the stretching involvement might improve the outcome rather than the stretching procedure itself. Yamaguchi et al. (2005) compared static stretching and dynamic stretching on power output intended to measure the quadriceps, hamstrings, gluteus, and calf muscles of the subjects. The stretching protocols consisted of one set of five stretches for 30 seconds each, while the dynamic stretching consist of five slow and 10 fast repetitions of the same stretches. The power output with dynamic stretching was increased while there were no significant differences found for static stretching.

The latest studies have also proved that extensive total repetitions of dynamic stretching significantly impaired explosive performance. Herda et al. (2013) found out that extensive dynamic stretching at 12-15 repetitions x 4 sets (48-60 repetitions) significantly impaired (-9.7% to -13.3%) isometric leg flexion strength. Paradisis et al. (2014) showed that additional dynamic stretching of 20 repetitions x 1 set significantly delayed (-2.2%) 20 m sprint time, although it did not significantly alter vertical jump height. Turki et al. (2012) compared 10 m and 20 m sprint times among one, two and three sets of dynamic stretching in 20 m (about 14 repetitions). The results indicated that one and two sets of dynamic stretching significantly improved (2.7%) 20 m sprint times, but three sets of dynamic stretching significantly impaired (-2.7%) it. Franco et al. (2012) utilized dynamic stretching of 15 repetitions x 3 sets (5 repetitions slowly at first and then 10 repetitions as fast as possible). The results manifestedthat the mean and peak power outputs of Wingate cycle test after dynamic stretching was not significantly different from those after only a warm-up. These results suggest that explosive performance becomes impaired as the total repetitions of dynamic stretching increases. It would be difficult to propose an optimal protocol of dynamic stretching defined by duration. Thus, it seems appropriate that the volume of dynamic stretching should not be controlled by duration but by repetitions or distance in actual warm-up sessions (Yamaichi et al. 2014).

In none of previous studies, stretching duration did not take longer than two minutes. This may be the serious factor that the findings of the current study indicated that dynamic stretching caused more power decline than static stretching. Exercise induced muscle damage may be involved with dynamic stitching since CK values were also significantly increased with dynamic stretching. Blood plasma ratio of CK, which is accepted as one of the indicators of muscle damage, increases during the muscle damage (Schwane 2000). CK increases after the exercise and its peak time changes including the type of the exercise, intensity of exercise and duration of exercise. Exercise-induced muscle damage is known to cause reductions in maximal strength and performance (Newham et al. 1983; Cheung et al. 2003). Since the CK values were increased with more reduction with dynamic stretching compared to static stretching, it seems exercise induced muscle damage caused reduction in power with dynamic stretching more. Besides,ahigher fatigue index in after dynamic stretching compared static stretching further supports that muscle damage accompanied with neuromuscular fatigue which might have caused the decrements in power parameters.

CONCLUSION

To conclude, dynamic stretching caused significant decrease in power compared to static stretching. It may be because of different duration of stretching protocols. In addition, continuous dynamic activity may cause exercise induced muscle damage, consequently causing neuromuscular fatigue that may lessen the power production of wrestlers,more than static stretching activities before the competitions.

RECOMMENDATIONS

Wrestlers should avoid longer stretching activities right before the wrestling competitions since neuromuscular fatigue and consequent decrease in power may occur.

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