Jurnal Sains Sukan dan Pendidikan Jasmani Vol 9, No 1, 2020 (1-8)
ISSN: 2232-1918 / eISSN: 2600-9323
https://ejournal.upsi.edu.my/journal/JSSPJ

Acute effect of dynamic stretching versus combined static dynamic stretching on speed performance among male Sukma Sarawak 2016 sprinters

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DOI: https://doi.org/10.37134/jsspj.vol9.1.1.2020

Received: 22 February 2020, Accepted: 09 April 2020, Published: 14 June 2020

***Cite this paper* (APA):** Brahim, S., & Mohamad Chan, E. W. (2020). Acute effect of dynamic stretching versus combined static dynamic stretching on speed performance among male Sukma Sarawak 2016 sprinters. *Jurnal Sains Sukan & Pendidikan Jasmani*, *9*(1), 1-8. https://doi.org/10.37134/jsspj.vol9.1.1.2020

Abstract

The purpose of the study is to compare the effects of dynamic stretching and combined static dynamic stretching on speed performance among male Sukan Malaysia (SUKMA) Sarawak 2016 sprinters. 10 male sprinters (age=16-19 years old) were tested under two different stretching protocols which were dynamic stretching alone and combined static dynamic stretching. All of the participants were sprinters that qualify for SUKMA Sarawak 2016. Participants underwent the dynamic stretching alone and combined static dynamic stretching in counterbalanced order with 1-week wash-out period between both stretching protocols. Participants were tested using the 20-meter sprint test after each intervention. The result showed a significant sprint time difference between both interventions ($p<0.007$). Dynamic stretching alone (3.16±0.090) showed a faster time to complete the 20-meter sprint test compared to combined static dynamic stretching (3.39±0.239). In conclusion, dynamic stretching alone is better than combined static dynamic stretching prior to speed performance. Combining static and dynamic stretching activities prior to speed performance is not recommended.

Keywords: speed performance; dynamic stretching; static stretching; combined stretching

INTRODUCTION

Stretching has been proven to prevent muscle stiffness, reduced the risk of injuries and improved performance (Behm, Blazevich, Kay, & McHugh, 2015; Kisner, Colby, & Borstad, 2017). Stretching had been traditionally implemented prior to physical activity (Heyward &

Gibson, 2014; Waqqash, Osman, Nadzalan, & Mustafa, 2017). It is believed to improve performance and reduce chances of injury (Hartig & Henderson, 1999; Witvrouw, Danneels, Asselman, D'Have, & Cambier, 2003). There are different types of stretching protocols such as static, dynamic, ballistic and proprioceptive neuromuscular facilitation.
The static stretching protocol involves the body part to be stretched until the end range of motion (ROM) and held stationary for a period of time, usually 10-30 second. Static stretching helps to reduce muscle tension, increased freedom of movement, short term flexibility and reduce the risk of tendomuscular injuries.

Nowadays, dynamic stretching is more popular among athletes. Dynamic stretching involves controlled sports specific movement through an active range of motion. Studies which implements dynamic stretching has revealed that it can improve power (Yamaguchi, Ishii, Yamanaka, & Yasuda, 2007) and speed (Fletcher & Jones, 2004; Little & Williams, 2006). Dynamic stretching is designed to increase body temperature, heart rate and flexibility (Haff & Triplett, 2015).

Speed is crucial in almost all kind of sports either it is a team sport or an individual sport. Speed is believed to be a genetic quality skill, and less dependent on training. Among sprinters, speed is the most essential element that they need to have.
Static stretching benefits most in injury prevention, but at the cost of performance impairment (Haddad et al., 2014). Contrarywise, dynamic stretching has been proven to improve sports performance such as power (Yamaguchi et al., 2007) and speed (Fletcher & Jones, 2004; Little & Williams, 2006).

Nevertheless, Davis et al. (Davis, Ashby, McCale, McQuain, & Wine, 2005) argued that static stretching is more effective at increasing flexibility compared to dynamic stretching which may benefit for injury prevention. The theory is if dynamic stretching is performed after static stretching, it will reduce or remove the negative effects of static stretching (Behm & Chaouachi, 2011). According to Gelen et al. (Gelen, 2010), combined static and dynamic stretching has no adverse effect on sprint time.

Currently, it is still unclear whether the negative effect of static stretching will affect speed performance after combined with dynamic stretching. For that reason, there was a need to provide further evidence if combining static and dynamic stretching will improve or depreciate speed performance among sprinters.

METHODOLOGY

Research Design

The pre-experimental research design was selected for this study because the participants underwent both dynamic stretching alone and combined static dynamic stretching. There was a wash-out period of one week between each intervention to avoid the training effects of the first intervention to interfere with the second intervention.

Subjects

Purposive sampling was used to recruit 10 male Sarawak state sprinters for Malaysian Games (SUKMA) 2016 as participants for this study.

Instrument

The instrument was used in this study is the 20-meter sprint test. This test was used because maximum muscular power of sprinters was found to be significantly correlated with mean 20-meter velocities and with the time to reach maximum velocity (Morin & Belli, 2003). the 20-meter sprint test also has good test-retest reliability (r = 0.98) (Morin & Belli, 2003). The same examiner accessed the 20-meter sprint performance for each subject. The examiner utilized verbal cues to indicate the "go" signal and stopwatch to record the time of the sprint.

Procedure

Subjects were shortly briefed by the researcher before the testing was conducted. Subjects signed informed consent before participating in the study. Subjects were told to stay inactive 24 hours prior to testing. The term "inactive" here means no strenuous activity 24 hours before the test.

Subjects were informed to run along the 20-meter line after each treatment and time for each one of them will be recorded. Data were recorded in seconds. Dynamic stretching focused on movement that duplicated closely to sprinter which are high knees, kick back, straight leg skipping, knee skips, ankle hops, stride bounding and 10-meter sprint. In addition, the combined static dynamic stretching group did static stretching first then followed by dynamic stretching. Static stretching held for 30 seconds for each muscle group. The muscle group stretched during static stretching are the quadriceps, hamstrings, gastrocnemius, gluteus, adductors and hip flexors. After static stretching, subjects performed the dynamic stretching protocols, which is the same stretching protocols used in the first treatment. These exercises performed slowly and avoid bouncing movement because it may lead the subjects to do ballistic stretching.

The posttest was administered in the same method as the first day of testing. Data for each group were collected and recorded for data analysis.

Data Analysis

The data was analyzed using Statistical Package for Social Sciences (SPSS) 25.0 version software. The researcher utilized the non-parametric Mann Whitney U test to compare the two different interventions. The non-parametric test was used because the sample size is small and does not fulfil the requirements of the parametric test. The participants perform both conditions treatments on the 20-meter speed performance. The significant level for this study was set at $p<0.05$ as it intended to reject the null hypothesis.

RESULTS

Demographic information

The demographic information (mean±SD) of the subjects are as follows: age (17.9±1.281), weight (51.6±6.778), height (162.2±8.34). The oldest subject was 19 years old while the youngest was 16 years old. Furthermore, the maximum height of the subject is 170 cm tall while 145 cm is the height of the shortest subject.

Inferential Statistics

A Mann-Whitney U test was conducted to evaluate the difference between dynamic stretching alone and combined static dynamic stretching on the 20-meter sprint time. The results were significant, where $z = -2.609$, $p < .05$. From the result, dynamic stretching had an average rank of 7.05, while combined static dynamic had an average rank of 13.95. There was a significant difference between both treatments ($Z=-2.609$, $p=0.007$). The average subject's sprint performance was faster using the dynamic stretching alone (3.16±0.090) as compared to combined static dynamic stretching (3.39±0.239).

Table 1. Data of the subject's mean age, weight and height

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Age	10	16	19	17.90	1.071
Weight	10	44	63	51.60	6.778
Height	10	145	170	162.20	8.345

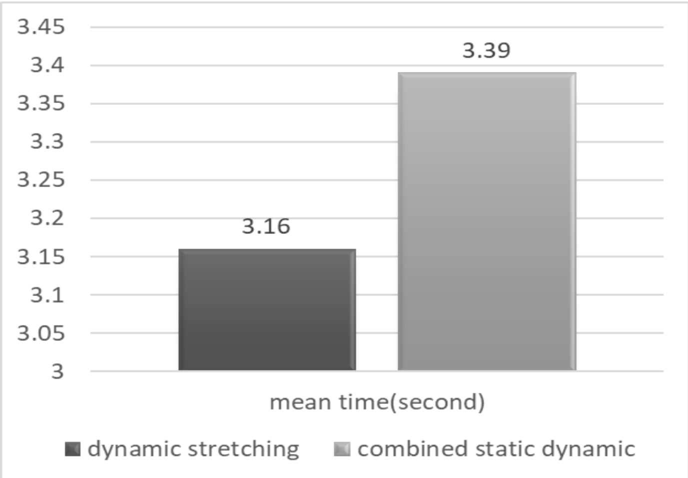

Figure 1. Mean difference between dynamic and combined static dynamic stretching

Table 2. Rank for both treatment

Ranks			
	Treatment	Mean rank	Sum of ranks
test	Dynamic stretching	7.05	70.50
	Combined static dynamic stretching	13.95	139.50

DISCUSSION

The purpose of the present research was to determine the best method to be implemented prior to sprint performance. The result showed a significant sprint time difference between both interventions Dynamic stretching alone had a faster time to complete a 20-meter sprint compared to combined static dynamic stretching. The decrease in performance with uses of static stretching is in consensus with previous studies findings (Haddad et al., 2014; Paradisis et al., 2014). The study by Young and Elliot (W. Young & Elliott, 2001) found that there was a decrease in muscle activation when static stretching was implemented. It also has been reported that static stretching which lasts longer than 90 seconds will generally impaired performance (Behm & Chaouachi, 2011). Supported with studies by Beckett et al. (Beckett, Schneiker, Wallman, Dawson, & Guelfi, 2009) if static stretching routines held less than 2-10 minutes also will impaired sprint performance. Therefore, the present study hypothesis was rejected with dynamic stretching was more beneficial for speed performance as compared to combined static dynamic stretching.

From the result, there were few subjects that did not have much difference in both treatments. This may be due to individual responds differently to combined static dynamic stretching and dynamic stretching routines. Different people tend to respond differently to different training. As in this case, subjects' response differently to treatments given. Another reason for this was trained athletes was more resistant toward stretch-induced deficit (Chaouachi et al., 2010). Since the athletes were well-trained, we believed that the athlete's physical and physiological aspect were adapted to a different type of stretching. In addition, Young and Behm (W. B. Young & Behm, 2003) found that by practice attempt of specific movement may reduce or diminish any potential negative effect of static stretching when implementing prior to dynamic warm-up. Bishop (Bishop, 2003) stated that active dynamic warm-up increases nerve impulses, changes in the force-velocity relationship, increases glycogenolysis, glycolysis, high energy phosphate degradation and enhance power. Another benefit of dynamic warm-up would be it helped to reduce muscle stiffness by breaking those stable bonds between actin and myosin filament (Bishop, 2003). A possible mechanism for this increase in performance using dynamic warm-up and decreases with static stretching was proposed by Rosenbaum and Hennig (Rosenbaum & Hennig, 1995) who found an increase in Achilles tendon compliance following a static stretch intervention. Both of them noted the group that involved in a jogging warm-up showed a stiffer tendon which can increase performance in force production.

Another possible mechanism had been proposed by Wilson, Murphy and Pryor (Wilson, Murphy, & Pryor, 1994), who suggested that for concentric muscle actions, a stiffer system would improve contractile component force production by allowing the more favourable length and velocity conditions. They proposed that at a given state of contraction, a stiffer musculotendinous unit should give rise to a greater length and a decreased shortening velocity of the contractile component, there placing the contractile component at a more optimum point on both of velocity and force, length curve in terms of force production. This was because there was less ''slack'' in a stiffer system that had to be taken up during the initial part of the contraction. Another possibility was that the performance had been hindered during the running portion of the sprint by a decreased ability of the musculotendinous unit to store elastic energy following a stretch-induced increase in musculotendinous compliance. Both muscular and tendinous tissues had the ability to stored elastic strain energy after being stretched by an external force. Although rejected by some researchers, many authors report that the stretch-shortening phenomenon might be partly explained by the release of elastic energy that was stored in the musculotendinous structures during the eccentric phase of stretch shortening-cycle exercises such as running, a mechanism referred to as elastic potentiation. The amount of elastic energy that can be stored in the musculotendinous unit was a function of the unit's stiffness and the extension produced by an imposed force (Shorten, 1987). Belli and Bosco (Belli & Bosco, 1992) suggested that an optimum stiffness might exist that maximizes

the magnitude of elastic energy return. Furthermore, they demonstrated that the active stiffness of the triceps surae, measured using a vertical oscillation technique with motion restricted to the ankle joint only, was, in fact, lower than the theoretical optimal stiffness calculated for their participants. Consequently, an acute bout of passive muscle stretching might compromise the effectiveness of the stretch-shortening cycle by decreasing active musculotendinous stiffness, thereby reduced the amount of elastic energy that can be stored and re-utilized.
A stretch-induced decrease in musculotendinous stiffness had been demonstrated in some studies (Magnusson et al., 1996) (Rosenbaum & Hennig, 1995), but not in others. In addition, McNair and Stanley (McNair & Stanley, 1996) found that passive stretching had no effect on the stiffness of the lower limb muscles during an isometric contraction at 30% maximal effort. However, none of these studies measured stiffness under dynamic conditions of repeated stretch-shortening cycles, and so the impact of passive stretching under actual sprinting remains to be determined. Interestingly, Nelson et al. (Nelson, Allen, Cornwell, & Kokkonen, 2001) showed that static stretching did not hinder maximal voluntary isokinetic knee-extension torque production at faster speeds of movement. Since movement speeds investigated in the Nelson et al. (Nelson et al., 2001) study were slower than the limb movement speeds in sprinting, one could have speculated that stretching would have little impact on sprinting. However, latest data indicated by Cramer et al. (Cramer et al., 2005) showed that reduction in isokinetic peak torque at both slow and fast movements, thus supporting the idea that pre-event stretching can restrict high-velocity strength performance. It was important to differentiate that while maximal voluntary isokinetic knee-extension torque production did not employ the stretch-shortening cycle, but sprinting does.

CONCLUSION

In conclusion, the researcher concluded that dynamic stretching alone is the best method to be implemented prior to sprint performance. In order to reduce the sprint time, performing dynamic stretching alone is better compared to combined static dynamic stretching. Future studies are recommended to increase the number of subjects for the study and to include additional assessment of leg power since sprinters used power to start their sprinting activities.

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ISSN: 2232-1918 / eISSN: 2600-9323
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