

THE EFFECTS OF TWO DIFFERENT TYPES OF DYNAMIC WARM-UP AND STATIC STRETCHING ON POWER AND SPEED

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Static stretching has often been found to decrease performance in power and speed activities, but dynamic warm-ups usually increase performance. We examined the effects of a mini-band warm-up, a medicine ball warm-up, and static stretching on 10m and 20m sprint times, as well as overhead medicine ball throw performance. Twenty-four Division I female soccer players completed the three warm-ups and a control 5 minute jog condition on separate days and were tested on the 10m and 20m sprint times and overhead medicine ball throw. ANOVA's and follow-up paired t-tests ($p < 0.05$) were used to determine differences between the warm-ups. Significant differences were found between groups for the 10m sprint times but not for the 20m sprint times or the overhead medicine ball throw.

KEY WORDS: mini-band warm-up, medicine ball warm-up, 10m sprint, 20m sprint, over the head medicine ball throw.

INTRODUCTION: Static stretching has been considered an essential component of warm-ups for decades (Young & Behm, 2002). Typically, a warm-up consists of some form of submaximal aerobic exercise with the goal of raising the core body temperature (Young & Behm, 2002; Young, 2007). Another part of the warm-up consists of static stretching (Behm & Chaouachi, 2010). Most past and current research shows static stretching decreases subsequent performance (Behm, Button, & Butt, 2001; Behm, 2004; Behm & Kibele, 2007; Fowles, Sale, & MacDougal, 2000; Kokkonen, Nelson, & Cornwell, 1998; Power, Behm, Cahill, Carroll, & Young, 2004; Behm & Chaouchi, 2010).

More recently, the active or dynamic warm-up has become increasingly popular and recent literature has shown increases in subsequent performance (Behm & Chaouachi, 2010; Holt & Lambourne, 2008; McMillian, Moore, Halter, & Taylor, 2006). There are primarily two types of a dynamic warm-up: dynamic stretching and dynamic movement. Dynamic stretching involves controlled movement through the active range of motion for a joint (Fletcher, 2010). Dynamic movement involves exercise and is likely to induce greater metabolic and cardiovascular changes than static stretching (Bishop, 2003a). Much of the recent literature has shown dynamic stretching and active warm-ups result in positive performance benefits (Bishop, 2003a, Bishop, 2003b; Behm & Chaouachi, 2010; Fletcher & Jones, 2004; Holt & Lambourne, 2008; McMillian et al., 2006; Young & Behm 2002).

Faigenbaum et al. (2006) tested short sprint type activities and took a unique approach of analysing the effect of different warm-ups while also utilizing a weighted vest. No significant differences between conditions were observed for the seated medicine ball toss or 10-yard sprint.

The backwards over-the-head medicine ball throw has been suggested as an appropriate method to assess total body power (Stockbrugger & Haennel, 2001). Mini band warm-ups have had little research to date, but they are commonly used in collegiate strength and conditioning programs. The theory behind the use of mini bands around the legs is to activate the muscles of the leg and increase the neural drive within those muscles (Cambridge, Sidorkewicz, Ikeda, & McGill, 2012).

Medicine ball warm-ups are also used in warm-ups in collegiate strength and conditioning. Medicine ball warm-ups involve holding a medicine ball and performing exercises in a controlled manner. Often the exercises chosen mimic the exercises that the athletes will be performing in their workouts. No research has been found that examines the use of medicine balls as a warm-up.

There is substantial research to support the assertion that static stretching has an acute impairment on performance. In addition, dynamic stretching and dynamic warm-ups improve performance. More research is needed to explore different types of dynamic warm-ups. Therefore, this study investigated the effects of static stretching, a mini-band, and medicine ball warm-up on 10m and 20 m sprint times and the overhead medicine ball throw.

The first purpose of this study was to determine if two dynamic warm-ups (medicine ball and mini-band) have a significant effect on performance in total body power output tests. A second purpose was to determine if static stretching has a negative effect on performance in total body power output tests.

METHODS: Twenty-four Division I women’s soccer players participated in this study to examine the effects of four different warm-ups (control, static stretching, dynamic medicine ball, and dynamic mini-band) on total body power output tests. The subjects were randomly assigned to one of four groups for testing purposes. All subjects performed one of the four warm-up conditions on different days followed by the over-the-head medicine ball throw and 10m and 20m sprint in random order. The over-the-head medicine ball throw was measured using a Martin 165ft/50m tape measure on the ground, with the throw recorded in meters. The 10m and 20m sprint times were measured using the Brower Speed Trap II Timing System (Brower Timing Systems, Draper, Utah) and recorded in seconds.

Testing took place over the course of four evening sessions at North Dakota State University’s Bison Sports Arena (BSA) Shelly Ellig Indoor Track Facility. Both dynamic warm-up conditions involved seven movements. The static stretching condition included eight stretches. See Table 1 for a list of the specific warm-up exercises. The control condition was a five minute jog around the track.

With the over-the-head medicine ball throw, subjects threw a 4 kilogram (kg) medicine ball backwards overhead (Stockbrugger & Haennel, 2001). The throw was measured where the ball landed alongside of the measuring tape. For the 10m and 20m sprint the subjects began on the start line in a 2 point runner’s stance. The timing was started by the researcher on the subjects’ first movement. Timing gates were set up at 10m to record 10m sprint times. The timing was stopped when the subject passed through the electronic gates at the 20m line.

Table 1: Warm-Up Exercises

Control Warm-Up	Mini-Band Warm-Up	Medicine Ball Warm-Up	Static Stretching Warm-Up
5 minute jog	Band Above Knees <ul style="list-style-type: none"> • Bodyweight Squats Band Below Knees <ul style="list-style-type: none"> • Monster Walks • Over-Stride Slide Band Around Ankles <ul style="list-style-type: none"> • Straight Leg Walks forward & backwards • Straight Leg Walks lateral Band Around Feet <ul style="list-style-type: none"> • Hip Flexion • Hip Rotation 	<ul style="list-style-type: none"> • Counterbalanced Squat • Overhead Chops • Forward Lunge with Twist Over Knee • Floor Pass • Counterbalance Romanian Deadlift (RDL) • Side Slams • Reverse Lunge with Bend Over Knee 	*All stretches were performed for both right and left sides <ul style="list-style-type: none"> • Groin • Hip flexor Lunge • Lying Glute • Lying Quad • Seated Hamstring • Standing Gastrocnemius • Arm Across Body • Arm Behind Head

SPSS version 22 was used to analyze the data. The best performance for each test was used for analysis with an alpha level of $<.05$. A repeated measure analysis of variance (ANOVA) was used for each testing protocol. If the ANOVA was significant, follow-up analyses using Bonferroni corrected pair-wise comparisons were conducted.

RESULTS: No significant differences were found between conditions ($F=1.65$, $p=0.25$) for the 20m sprint times. The means from the worst to the best 20m sprint performance were, mini-band warm-up ($3.56\pm.14s$), static stretching ($3.54\pm.11s$), medicine ball warm-up ($3.53\pm.13s$), and control ($3.50\pm.11s$). The ANOVA was found to be significant ($F=4.04$, $p=0.045$) for the 10m split times. The means from the worst to the best 10m sprint performance were, mini-band warm-up ($2.12\pm.10s$), medicine ball warm-up ($2.09\pm.08s$), static stretching ($2.08\pm.08s$), and control ($2.04\pm.08s$). Paired sample t-test follow-up analyses showed a significant difference between the mini-band and control conditions ($t=2.73$, $p=.02$) and between the medicine ball warm-up and control condition ($t=2.78$, $p=.02$). The control condition resulted in the best performance in both cases.

No significant differences were found between conditions ($F=0.87$, $p=.49$) for the over-the-head medicine ball throw. The means from the worst to best performance were, mini-band ($7.09\pm.97m$), medicine ball ($7.11\pm 1.29m$), control ($7.26\pm.99m$), and static stretching ($7.37\pm 1.13m$).

DISCUSSION: Based on the results of other similar studies, we hypothesized that static stretching and the control condition would result in the lowest performance. However, we found that the mini-band warm-up resulted in the worst performance in the 10m and 20m sprint times and the control condition resulted in the best performance. For the over-the-head medicine ball throw there were no significant differences.

Our results do not agree with Fletcher and Jones' (2004) results, where they examined the effects of static and dynamic stretching on the 20m sprint. They found that static stretching resulted in a significant increase and dynamic stretching led to a significant decrease in 20m sprint times. Our results also contradict McMillian et al. (2006), who found that a dynamic stretching group had better performance in an underhand medicine ball throw than a static stretching group. The results of the McMillian et al., 2006 study are consistent with Bishops' (2003b) review of the literature, indicating that an active warm-up of moderate intensity is likely to significantly improve short-term performance as long as fatigue is not induced (Bishop, 2003b; McMillian et al., 2006).

However, our results agree with a study by Faigenbaum et al. (2006). They found no significant differences in a seated medicine ball throw or 10 yard sprint times after completing static stretching and three dynamic warm-ups of varying intensity using a weighted vest. The athletes in our study had completed sport related practice earlier in the days we did testing and they had a long soccer tournament during one of the weekends between our testing days. These factors could have resulted in fatigue in the subjects on top of the fatigue from completing the study, which may have affected our results.

CONCLUSION: In conclusion, both the mini-band and medicine ball warm-up were found to significantly negatively affect 10m sprint times and had no effect on 20m sprint and overhead medicine ball throws. It is possible that fatigue from previous sport practices earlier in the day and a long tournament during a weekend may have affected our results. If athletes have had excessive physical activity previously, it might be important to consider decreasing warm-ups for subsequent practices or power and speed testing.

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Acknowledgement

The researchers thank the NDSU soccer for participating in this research study and the coaches for allowing us to use their athletes.