The Effects of Warm-Up on Force Production in D1 Sprinters

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Abstract

A great debate lies in various types of warm-ups and their effectiveness for proper preparation for exercise (Fradkin et al., 2010). For many years, literature supported the use of a traditional static stretching warm-up but in recent years a dynamic warm-up has become more prominent (Page, 2012). Many studies have been conducted to determine the optimal warm-up type.

- **Purpose-**The purpose of this study is to discuss the effects of static and dynamic warm-up on lower body force production in male D1 collegiate sprinters.
- **Hypothesis-** It was hypothesized that a dynamic warm-up will result in more force production of the lower body due to the support of a dynamic warm-up in the literature and the sport-specific movements incorporated in the warm-up.

Introduction

Warm-ups are essential for injury prevention and mental preparation, but most importantly for preparing the body for exercise or competition (Sports Medicine Information, 2009). Preparation for exercise can be carried out by various warm-up types such as static and dynamic warm-ups. Subjects completed both conditions and force production was compared between each. All subjects completed a brief general warm-up before beginning their assigned warm-up protocol for that session. After completing the general warm-up, all athletes proceeded to complete their randomly assigned SS or DS protocol for that testing session.

The warm-ups were as followed:

- **Static Warm-Up:** The SS protocol included static stretching of the hamstrings, glutes, calves, lower back, and shoulders. Subjects held the stretches for 45-seconds, rested for 30-seconds, and then repeated the stretch.
- **Dynamic Warm-Up:** The DS protocol included various exercises for 40 yards with a jog back. The exercises were as follows: skip with bodyweight squats, skip with a toe touch, skip with arm circles, high knees and butt kicks. The subjects could rest as needed between each exercise.

Review of Literature

- **Kyranoudis et al. (2018)** found that a Static Warm-Up had a negative effect on sprint time in amateur soccer players, while a Dynamic Warm-up had no effect.
- **Frantz & Ruiz (2011)** found that a Dynamic Warm-up created more lower-body explosiveness when compared to a Static Warm-Up. Participants were collegiate baseball players.
- **Kistler et al. (2010)** found that a Dynamic Warm-up decreased sprint time and a Static Warm-Up adversely affected sprint time. Participants from the study were members of the Miami University Track and Field team.
- **Washif et al. (2015)** found that a Dynamic Warm-Up positively influenced peak power production in a jump test. Static Warm-Up has no effect on this variable. Thirteen young male sprinters participated in this study.

Materials & Methods

Participants: 20 male Division 1 Collegiate sprinters.

Inclusion Criteria: Subjects must be a male Division 1 Sprinter, between the ages of 18-24, no lower body injury in the last month, and have extensive experience with sprint starts and starting blocks.

Research Design: The study used a quantitative within-subject experimental design, with all athletes completing both a Static Stretching (SS) and a Dynamic Stretching (DS) condition. Data were collected across 2 test sessions that were separated by a period of one week. The effects of the procedures were evaluated by comparison of force production values across the 2 conditions.

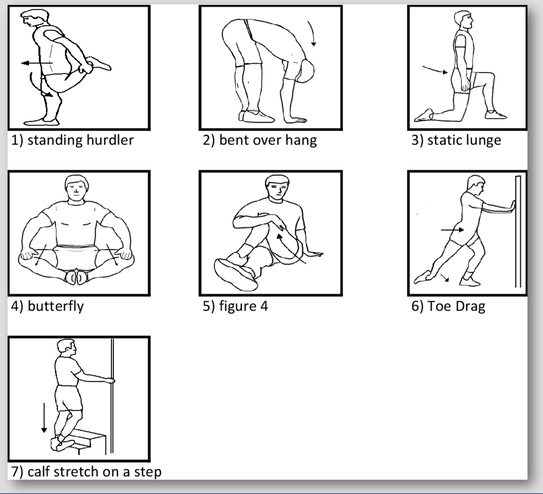
Instrumentation: The KiSprint starting blocks were used to collect data and analyze force production. The starting blocks record 3-D forces for each leg.

Procedures: The experimental SS and DS protocols were adopted from the Gardner-Webb University Track and Field team. Therefore, all subjects were familiar with each of the warm-up protocols. Following the SS or DS protocols, the subjects performed three 30-meter sprint starts. The trials were separated by 5-minutes, and the first trial was completed no more than 2 minutes after completion of the SS or DS protocol.

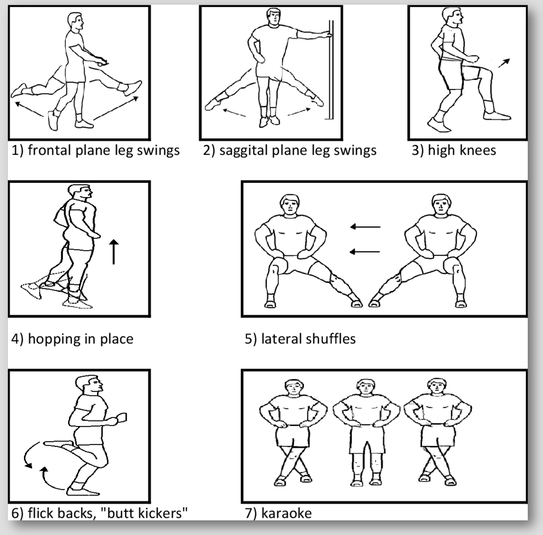
Data Analysis: ANOVA was used to analyze each warm-up procedure and their effect on force production. Descriptive statistics for each variable were collected through the KiSprint System.

Static and Dynamic Warm-Ups

Examples of Static Stretching



Examples of Dynamic Stretching



Operational Definitions

- ***Static Warm-Up.*** A warm-up that involves stretching of muscles by holding a specific position with muscle tension until a stretching sensation is achieved and repeated (Page, 2012).
- ***Dynamic Warm-Up.*** A warm-up that involves active, often sport-specific, movements that create a full range of motion in joints and muscles (Alipasali et al, 2019).
- ***Lower Body Force Production.*** The capacity to achieve peak voluntary activation in the initial process of an explosive muscle contraction, primarily as a function of the lower body's increased rate of motor unit discharge (Maffiuletti et al., 2016).

Discussion

Limitations: A limitation of this study was the small number of subjects tested. Only 20 male Division 1 collegiate sprinters participated in this study. A further limitation of this study was that each subject came from the same university and received the same level and intensity of collegiate training. Therefore, the results collected from this study could not be generalized for all male division 1 collegiate sprinters.

Future Application: Further research involving sprinters may be necessary to understand the effects of warm-up on force production, especially during a sprint start. Current research is limited to team sport settings. Overall, the discussion of warm-ups and their effects on performance indicates the need for further research on this subject.

Acknowledgements

- I would like to thank Dr. Hartman for teaching us the necessary information to perform this study and his assistance through the process.
- I would like to thank Kayla Curatolo for her extensive help editing and revising this work.
- I would like to thank Gardner-Webb University Library staff for providing research consultation.
- I would also like to thank the AV Department for kindly printing this research.
- I would like to thank the Gardner-Webb Writing Center for providing revisions and research assistance.
- Lastly, I would like to thank my peers for assisting us through this process and reviewing our work.

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