Journal of Science and Medicine in Sport (2007) **10**, 403—410

ELSEVIER

Journal of Science and Medicine in Sport

www.elsevier.com/locate/jsams

ORIGINAL PAPER

Warm-up or stretch as preparation for sprint performance?

Matthew Stewart[a], **Roger Adams**[b], **Albert Alonso**[c,*], **Blake Van Koesveld**[b], **Scott Campbell**[c]

[a] *SportsPhysio West, 116 Macquarie Street, Parramatta, NSW 2150, Australia*
[b] *School of Physiotherapy, Faculty of Health Sciences, University of Sydney, Lidcombe, NSW 1825, Australia*
[c] *Bulldogs Rugby League Football Club, Belmore, NSW 2192, Australia*

Received 31 January 2006; received in revised form 20 September 2006; accepted 4 October 2006

KEYWORDS
Warm-up;
Stretch;
Sprint;
Randomised controlled trial

Summary Warm-up and stretching are widely used as techniques in preparation for intense physical activity, yet there is little information available to compare their effectiveness in relation to athletic performance. Fourteen elite Under-19 year old rugby league footballers undertook each of four preparation protocols (no preparation, stretching only, warm-up only, warm-up and stretching) in four successive testing sessions. Protocols were randomly allocated to players in a counterbalanced design so that each type of preparation occurred equally on each day of testing. During each session, athletes performed three solo sprint trials at maximum speed. Sprints were of 40-m distance and were electronically timed with wind speed and direction recorded. Preparation involving warm-up resulted in significantly faster sprint times compared to preparations having no warm-up, with a diminishing effect over the three trials. On the first trial, warm-up resulted in a mean advantage of 0.97 m over 40 m. Stretching resulted in a mean disadvantage of 0.18 m on the first trial, and no significant effect overall despite significant wind assistance. Warm-up was effective at improving immediate sprint performance, whereas an equivalent duration of lower limb stretching had no effect.

Introduction

Pre-exercise stretching is a convention among athletes worldwide.

The three key perceived benefits of stretching prior to athletic activity are: reduced risk of injury, decreased post-exercise muscle soreness and improvement in athletic performance.[1] Recent large randomised controlled trials have questioned the validity of this perceived reduction in injury risk[2,3] and there is no proven reduction in post-exercise muscle soreness after pre-exercise stretch.[1] Yet pre-exercise stretching

* Corresponding author at: 4 Ethel Street, Burwood, NSW 2134, Australia. Mobile: 61 411 798 897; fax: +61 2 9718 8012.
E-mail address: albert_alonso@connexus.net.au (A. Alonso).

1440-2440/$ — see front matter © 2006 Sports Medicine Australia. Published by Elsevier Ltd. All rights reserved.
doi:10.1016/j.jsams.2006.10.001

remains widespread, possibly due to the perception that it may improve athletic performance. Currently, there are few studies that have directly investigated the effect of stretching prior to the performance of a sprint. One recent study has indicated that pre-exercise stretching may negatively impact on a 20-m sprint.[4]

Similarly, the process of warm-up is accepted and performed prior to nearly every athletic event.[5,6] Clinical research regarding warm-up and its effect on subsequent athletic activity is limited and often confounded by it being combined with other interventions.[6] To date, no research study has examined the relationship between warm-up and injury risk, and those that have looked at warm-up and post-exercise muscle soreness did not find any preventive effect.[7–9] The effect of warm-up on athletic performance has been widely studied,[10–15], but the research does not consistently demonstrate a link between warm-up and enhanced performance. This is likely to be attributable to wide variations in the warm-up mode, duration, intensity and length of recovery (time delay between cessation of warm-up and commencement of performance) employed in the various studies.

The aim of the present investigation is to compare the effect of no preparation, pre-exercise stretching, pre-exercise warm-up and a combination of warm-up and stretching on 40-m sprint performance in elite under-19 rugby league footballers. By specifically looking at warm-up and stretching, individually and in combination, the purpose is to determine if these commonly used pre-athletic activities do enhance performance. Accordingly the hypotheses are that preparations involving warm-up will result in faster sprint performance than those without warm-up and that preparations involving stretching will result in better performance than those without stretching.

Methods

Study design

A randomised, four condition, repeated measures design using a counterbalanced format, allowing subjects to act as their own controls.

Subjects

Subjects were elite athletes, playing for the Bulldogs Rugby League Club, participating in the New South Wales (Australia) Rugby League Under-19s State Competition. All subjects were required to be free of injury on all 4 days of data collection. Prior informed consent was obtained from each subject and approval was granted by the Human Research Ethics Committee of The University of Sydney. Of 17 subjects who initially consented to participate in the study, three were unable to attend all 4 testing days. The remaining 14 subjects who completed all four testing sessions were included in the data analysis.

Procedures

Subjects were randomly allocated into four groups, then each group was randomly allocated to a testing condition. The groups cycled through the four conditions in order over 4 testing days, Tuesday and Thursday of 2 successive weeks (Table 1). Random allocation was achieved using a random number table (Rand Corporation 1955) and a blind allocator. After the allocation process, the groups were named (A, B, C, D) to resemble the order of testing. Each member within a group was given a number so that they could be identified by codes (e.g. A4, B2) which were marked on the leg of individual athletes every testing day.

All subjects were instructed to perform only their 'normal' activity (such as work or study) and were requested not to undertake any exercise or stretching activities prior to testing. Scheduled team training occurred after testing. To optimise the trade-off between experimental control and external validity, the testing was conducted outdoors with exposure to wind changes, but on a concrete surface to give all runners good footing. Subjects were asked to wear appropriate running shoes for the concrete test surface and to wear the same shoes on each testing day. Throughout the structured warm-up and stretching sessions, the athletes were supervised by the club's strength and conditioning coach and given standardised instructions. The instruction to perform the 40-m sprint to

Table 1 Latin square arrangement of group conditions for testing

	Day 1	Day 2	Day 3	Day 4
Group A	No preparation	Warm-up only	Warm-up and stretching	Stretching only
Group B	Warm-up only	Warm-up and stretching	Stretching only	No preparation
Group C	Warm-up and stretching	Stretching only	No preparation	Warm-up only
Group D	Stretching only	No preparation	Warm-up only	Warm-up and stretching