

DETERMINATION OF THE OPTIMAL ANTECEDENT PREPARATION FOR TORQUE, POWER, ACCELERATION AND WORK PRODUCTION

¹Ian Heazlewood and ²Tony Boutagy

¹Charles Darwin University,

²ACU National; email ian.heazlewood@cdu.edu.au

INTRODUCTION

Disparity exists in the literature as to whether or not flexibility exercises should be used in the warm-up period prior to muscular performance. A number of studies explain the biomechanical role of warm-up [1,2], a number of studies have shown stretching to have deleterious effect on force, speed and power production [3], whereas other investigations have shown no effect [4] or no differences when using different warm-up protocols [4,5,6]. A limitation in the current body of literature is a lack of studies comparing several stretching interventions and warm-ups on comparable force, power, speed and continuous muscular work tasks using multivariate approaches that examine the influence of stretching and antecedent warm-up strategies.

METHODS

Sixty healthy, physically fit, active males (N=32) and females (n=28) participated in the study (mean age = 25 years; mean height = 175cm; mean weight = 70kg). Subjects were randomly assigned to one of six treatment groups. Each treatment group comprised of ten participants. The treatment groups consisted of three separate flexibility interventions (static, PNF and active mobility stretching), one specific warm-up intervention, one combined PNF with specific warm-up intervention and one control group. All subjects were tested 5 minutes pre and 2 minutes post intervention. Muscular performance was measured on the CYBEX 340 isokinetic muscle evaluation system with HUMAC software at isokinetic speeds of 60, 180 and 300°s⁻¹ using leg extension/flexion to assess torque, muscular work and fatigue index. Leg power indices of contact time, flight time and height were assessed with Speed Light Sports Timing System using jump mode and acceleration at 10m using timing gates was tested with the same instrument.

RESULTS AND DISCUSSION

MANOVA analysis indicated the results were borderline in terms of statistical significance, (Pillai's Trace = 1.249, F=1.305, hypoth. df=60, error df=235, p=.085; Wilks' Lambda = 0.202, F=1.393, hypoth.; df=60, error df=205, p=.047).

However, follow-up tests indicated some interesting univariate sources of significant difference. Vertical jump height, flight time and contact time were not impacted by any warm-up treatment. Sprint times were negatively influenced by PNF stretching. Warm-up sets, static and active mobility stretching and combined PNF stretching and warm-up sets had no effect. Peak torque, total work and fatigue index at 300°s⁻¹ were not impacted by any warm-up treatment. Lower limb strength and ability to perform work at speeds of 180°s⁻¹ were improved after the performance of static stretching but impaired after PNF and active mobility stretching, respectively. All other interventions had no effect. Peak torque at 60°s⁻¹ was not influenced by any warm-up intervention.

CONCLUSIONS

Antecedent activities or warm-up activities are included in many sports prior to maximal effort competition, in the belief that subsequent performances will be enhanced. The outcomes of such practices based on this research indicate the interactions at the holistic/organism level and dependent on torque, work, power and acceleration are complex. This requires the coach to have an understanding of the complex effects of different types of warm-up. Warm-up protocols that differentially influence the biomechanical constructs of torque, work, power and acceleration. The applied sport implication is a further fine tuning of warm-up protocols articulated with sport specific outcome.

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