THE EFFECTS OF FATIGUE AND GENDER ON PLANT LEG GROUND REACTION FORCES AND KINEMATICS DURING A MAXIMAL INSTEP SOCCER KICK

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INTRODUCTION

The culmination of biomechanical motions resulting in an accurate and successful soccer kick is well developed in skilled players [1]. However, the final minutes of a soccer match are the most dangerous, as the ability to properly execute a kick declines when contributing muscle fibers become fatigued [2]. As fatigue sets in, changes to ground reaction forces (GRFs) are present [3]. It is questioned whether this incidence places an individual at risk for injury to the ACL [4], as the dynamic stability of the knee joint is compromised. The purpose of this study was to assess the effects of fatigue on GRFs and kinematic data during a maximal instep kick in male and female soccer players.

METHODS

Twelve female and 14 male amateur soccer players with a minimum of 10 years experience performed 3 maximal instep kicks prior to and following a 90 min fatigue protocol. The fatigue protocol included 9,600 m of walking, sprinting, running, and changes in direction, simulating a soccer match [3] (Mean HR=182±7.8 bpm). GRFs (600Hz) of the plant leg, as well as knee and trunk angles (60Hz) were collected at heel strike and just prior to ball contact in rested and fatigued conditions. Repeated measures 2x2 ANOVA ($p < 0.05$) were used to analyse the data.

RESULTS AND DISCUSSION

Significant decreases were found with fatigue in ball velocity and knee angle, while impulse increased with fatigue (Table 1). Gender differences were found in trunk angle at heel strike and just prior to ball contact, as well as anterior-posterior forces just prior to contact. Women had significantly more knee flexion just prior to ball contact than the men. There was a significant interaction effect between gender and fatigue in the anterior-posterior forces. Although ball velocity and anterior-posterior forces decreased significantly, peak vertical forces did not decrease (Figure 1-2) as reported in the literature [3].

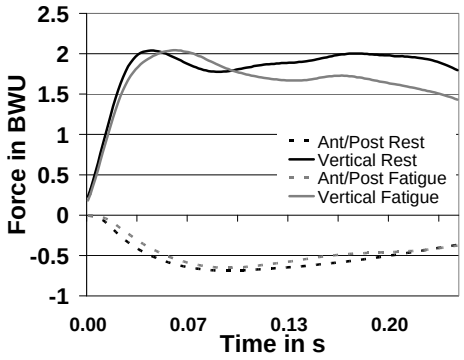

Figure 1: Female typical GRFs with fatigue.

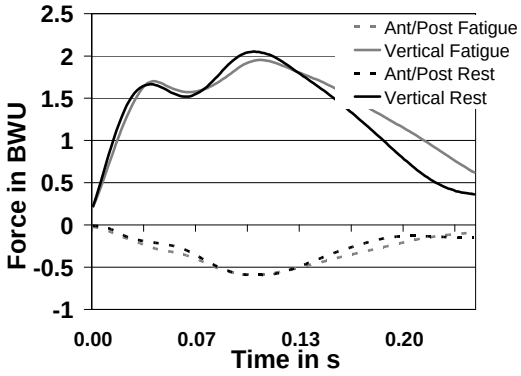

Figure 2: Male typical GRFs with fatigue.

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Table 1: Ground reaction forces and trunk and knee angles at heel strike and just prior to ball contact.

	Angles (degrees)				Forces (BWU)			
	Knee Ground	Knee Ball	Trunk Ground	Trunk Ball	Vertical Peak	Vertical Ball	Ant/Post Peak	Ant/Post Ball
Women								
Rested	146 ± 6*	130 ± 11*^	-7 ± 6^	-2 ± 7^	2.12 ± 0.31	1.85 ± 0.36	0.67 ± 0.17	0.60 ± 0.19^
Fatigued	143 ± 9*	129 ± 13*^	-6 ± 6^	1 ± 6^	2.05 ± 0.26	1.84 ± 0.40	0.65 ± 0.19	0.56 ± 0.21^
Men								
Rested	150 ± 8*	139 ± 8*^	-9 ± 5^	-7± 6^	2.15 ± 0.47	2.10 ± 0.33	0.81 ± 0.24	0.76 ± 0.28^
Fatigued	149 ± 7*	137 ± 8*^	-10 ± 5^	-7 ± 7^	2.11 ± 0.38	2.10 ± 0.27	0.79 ± 0.21	0.76 ± 0.22^

* $p < 0.05$ with fatigue. ^ $p < 0.05$ with gender.