P-C-34: Fatigue alters turns kinematics in female soccer players

Claudia Brunetti(1), Matteo Zago(1), Filippo Bertozzi(2), Francesca Salaorni(1), Alice Gatti(1), Chiarella Sforza(2), Manuela Galli(1)
(1)Politecnico di Milano, (2)Università degli Studi di Milano

BACKGROUND AND AIM: Anterior Cruciate Ligament (ACL) rupture is among the most severe injuries in women soccer, accounting for 43% of absence from match play [1]. ACL injury mechanism involves multiplanar movement patterns that can occur during landing, turning, cutting or pivoting actions [2]. Despite fatigue may have an effect in enhancing ACL injury risk [3], its impact on movement mechanics is still unclear [4]. Our aim is to deeper understand these mechanisms, which would expand the basis of

evidence for the development of prevention programs. METHODS: Nine élite female soccer players (age: 20-31 years, BMI: 18.4-22.7 kg·m⁻²) belonging to the first or second Italian division ("Serie A" and "B") completed a 5-m shuttle run test until exhaustion, paced at 70% of their own Maximal Aerobic Speed (2.6 ± 0.2 m·s⁻¹). The three-dimensional position of 37 reflective markers was acquired during the test with an optoelectronic motion analysis system (BTS, Italy). Peak blood lactate concentration was measured at the end of the test. Hip, knee and ankle 3D kinematics were obtained from a biomechanical model developed in Visual 3D (CMotion, USA). Statistical Parametrical Mapping (SPM) paired t-tests were used to compare joint kinematics during the stance phase between the turns 6-10 and the last 5 turns performed with the preferred leg. RESULTS: Post-exercise blood lactate concentration was 10.7 ± 3.0 mmol·L⁻¹. The hip was more extended at mid-stance ($p = 0.038$, $t = 2.398$), as well as the knee ($p = 0.005$, $t = 2.635$). The tibia was more internally rotated from 20% to 80% of the stance phase ($p < 0.001$, $t = 2.677$). No significant differences were observed at the ankle level. CONCLUSIONS: These findings depict a sequence of concatenated alterations to the mechanics of changes of direction that are commonly described as biomechanical risk factors for ACL injury [2]: reduced knee and hip flexion ("stiff" landing), tibial internal rotation and knee dynamic valgus. Surprisingly, we did not observe alterations in knee kinematics on the frontal plane: it could be either that the high training level of the assessed cohort did not let such difference emerge, or that while the drop between the fresh and the fatigued condition was not significant, the baseline value (10-15 degrees of knee abduction) is potentially hazardous per se, even before the onset of fatigue. As outlined in a recent work on men [3], it is confirmed and reinforced (given the higher incidence in women [4]) the need of planning specific neuromuscular exercises at the end of trainings, as when players are fatigued they can get the highest benefit from tackling modifiable biomechanical risk factors. 1. Larruskain et al., Scand J Med Sci Sport, 28:237-245, 2018. 2. Fox et al., Sports Med, 44:815-832, 2014. 3. Zago et al., Eur J Sport Sci, 19:1072-1081, 2019. 4. Bourne et al., Sports Med, 49:1629-1635, 2019.