# Comparison of Male and Female Rugby Athletes Biomechanics During a Cutting Movement

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## Summary

This study compared lower extremity biomechanics during a cutting movement between male and female rugby players. Males generated greater absolute ankle moments, powers, and ground reaction forces, however, once these variables were normalized to the body weight and height of the participants, the only difference present was in the horizontal ground reaction force.

## Introduction

Rugby is a high contact sport with one of the highest injury rates in sport [1]. While previous research has primarily focused on male rugby athletes, limited attention has been given to female rugby athletes, despite evidence of distinct movement patterns between male and female athletes [2]. If female and male rugby players have different kinematics and kinetics during the movement, this may necessitate sex-specific equipment such as footwear or sport surfaces. Therefore, the purpose of this study was to investigate the biomechanical differences between male and female rugby players during a cutting movement.

## Methods

A total of 30 adult university rugby players, twenty-two females (mean ± SD, height: 169.4 ± 5.6 cm, mass: 73.7 ± 11.3 kg) and eight males (mean ± SD, height: 178.4 ± 7.8 cm, mass: 84.2 ± 16.4 kg) participated in this study, in which athletes performed a v-cut movement (90˚ change of direction) at maximal effort on infilled artificial turf (FieldTurf). Retroreflective markers were attached to each athlete's forefoot, rearfoot, lower leg, upper leg, pelvis, and torso (three markers per segment) and the kinematics and kinetics were quantified using a 12-camera motion capture system (Vicon) and force plate (Kislter). All athletes wore a control shoe (Adidas Copa Mundial), which was available in a range of sizes.

The kinematic and kinetic data were analyzed in Visual3D, where resultant joint moments and joint powers of the ankle, knee and hip were calculated. Data were then imported into Sift software, where curve registration and statistical parametric mapping (SPM) was performed to compare both the absolute ground reaction forces, joint moments and powers as well as normalized ground reaction forces (BW), joint moments (BWH) and joint powers (BWH) between male and female athletes ($\alpha$=0.10).

## Results and Discussion

Significant differences of the non-normalized and normalized forces, moments and powers are highlighted in Table 1. When no normalization of the data was conducted, the sagittal plane ankle moment, ankle power, vertical ground reaction force, and horizontal ground reaction force was significantly greater in male athletes compared to female athletes (during mid to late stance). However, once normalized based on the athlete's body weight and height, only a single significant difference between the two groups remained, with the horizontal ground reaction force being significantly greater for males compared to females during early stance.

These data indicate that while males can generate greater absolute moments, powers, and forces during a cutting movement, when normalized for the size of the athlete, minimal differences exist between males and females.

Further research is required, to specifically investigate how this data may influence the specific footwear and sport surface requirements of male and female athletes. Specifically, how the properties of the surface or footwear may be optimized for the lower absolute forces applied by female athletes.

**Table 1:** Absolute and normalized variables and corresponding percent of stance phase where significant differences ($p<0.10$) between males and female were present.

| Variable | Absolute (% of stance phase) | Normalized (% of stance phase) |
|---|---|---|
| Sagittal Ankle Moment | 63-94 | - |
| Ankle Power | 85-96 | - |
| Vertical GRF | 65-92 | - |
| Horizontal GRF | 68-89 | 5-7 |

## Conclusions

These findings highlight the importance of normalizing for anthropometric differences in biomechanical data when comparing male and female athletes. Moments, powers, and forces during v-cut movements show minimal significant differences once normalized. Further analysis of various movements is needed to identify potential biomechanical differences between these populations.

## Acknowledgments

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## References

[1] Williams et al. (2013). *Sports Medicine (New Zealand)*, **41**: 903-923.
[2] Ferber et al. (2003) *Clinical Biomechanics (Bristol)*, **18**: 350-357.