# Is performance in basketball referees affected by gender?

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**ABSTRACT**

The workload performances have an important role in decisions making of basketball referees. But it is not known if the gender influences this load. Therefore, the aim of this study focuses on knowing the existing differences according to the gender in workload during competition. The participants were nine international basketball referees (six male and three female). In each game participated three referees. Fifteen matches were registered during U-16 Female EuroBasket. The variables analysed were: Accelerations, Decelerations, Speed, Distance, Distance in different intensities (walking, jogging, running and sprinting) and Player Load. Each referee was equipped with WIMUPROTM inertial device with Ultra-Wide Band systems. For the statistical analysis the U-Mann-Whitney test was used. Only there were significant differences in Acc/min and Dis/min between men and women. In conclusion, the gender should not be predictive on competitive workload of basketball referees, because both of them must perform similar movements according to the game. **Keywords**: Basketball; Referees; Gender; Workload; Competition.

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## INTRODUCTION

Exists numerous studies to analysed the performance load during competition in basketball players, but there are few investigations related to the referees. These demands of internal and external load acquire great importance in decision-making, since they must maintain an adequate physical condition to be able to accurately assess the different situations that occur in a match (Ahmed, Davison & Dixon, 2017). For this reason, the objective of this paper focuses on knowing the differences between gender in external load basketball referees during an international U-16 competition.

## MATERIAL AND METHODS

### *Participants*

The study sample consisted of nine international FIBA referees (3 women and 6 men). They refereed FIBA U16 Women´s European Championship 2017. Each referee participated in five games. All of them were informed of the experimental protocol and its possible benefits.

### *Measures*

The independent variable was gender. The variables used to describe the workload basketball referee were:

- Accelerations (ACC) and Decelerations (DEC): Speed and directions changes made during the game. In this case, was recorded the total number, per minute and maximum accelerations and decelerations.
- Speed (S): The rate of change of distance travelled with respect to time. The average and maximum speed were calculated.
- Distance (Dis): The full length of a match. It was classified according to intensity: walking (0-6 km/h), jogging (6-12km/h), running (12-18 km/h) and sprinting (18-21 km/h).
- Player Load (PLTM): The neuromuscular load of each referee (Cormack, Mooney, Morgan & McGuigan, 2013). It is an objective load measurement, validated and calculated from accelerometer signal in the 3 axes (Schelling & Torres, 2016).

### *Procedures*

For recording of variables were used a WIMUPROTM inertial devices with Ultra-Wide-Band (UWB) technology. Each inertial device was placed 20 minutes before starting the game on the top of the referee's back within a specific anatomical harness. The UWB system was adjusted to the measurements of the pitch before competition, placing six radiofrequency antennas around the court.

### *Analysis*

The S-PRO software was used to obtain the data. The U-Mann-Whitney test was performed to know the differences between gender. The statistical program used was SPSS (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 21.0, Armonk, NY: IBM Corp.). The degree of significance ($p \leq .05$) was calculated accurately with the Monte Carlo method, with 99% confidence intervals.

## RESULTS

The results of the study show that there are significant differences in Acc/min ($p=.017$) and Dis/min ($p=.034$), being always higher in women.

| Variables | U de Mann-Whitney | Z | Sig. Monte Carlo (bilateral) | | |
|---|---|---|---|---|---|
| | | | Sig. | Confidence Interval (99%) | |
| | | | | L | U |
| Accelerations (n) | 197.000 | -.674 | .507[b] | .494 | .519 |
| Acc/min (m/s$^2$) | 125.000 | -2.408 | .017[b] | .014 | .020 |
| AccMax (m/s$^2$) | 215.500 | -.229 | .827[b] | .817 | .836 |
| Decelerations (n) | 191.000 | -.819 | .410[b] | .398 | .423 |
| Dec/min (m/s$^2$) | 151.000 | -1.782 | .074[b] | .068 | .081 |
| DecMax (m/s$^2$) | 219.000 | -.144 | .893[b] | .885 | .901 |
| SpeedMax (km/h) | 188.500 | -.879 | .393[b] | .380 | .405 |
| SpeedMed (km/h) | 221.000 | -.096 | .925[b] | .918 | .932 |
| PlayerLoad | 156.500 | -1.649 | .098[b] | .090 | .106 |
| PlayerLoad/min | 202.500 | -.543 | .596[b] | .583 | .608 |
| Distance (m) | 172.000 | -1.276 | .204[b] | .193 | .214 |
| Distance (m/min) | 138.000 | -2.095 | .034[b] | .029 | .039 |
| Dis 0-6km/h | 205.000 | -.482 | .641[b] | .629 | .654 |
| Dis 6-12km/h | 166.000 | -1.421 | .156[b] | .146 | .165 |
| Dis 12-18km/h | 220.000 | -.120 | .911[b] | .904 | .918 |
| Dis 18-21km/h | 202.000 | -.554 | .594[b] | .581 | .606 |

## DISCUSSION

External load variables allow establish a performance profile during competition. Considering the results obtained, it is possible that there are only differences in the Acc/min and Dis/min because the referees must perform similar movements during the game (García-Santos, Gamonales, León & Muñoz, 2017). The importance of analysing these variables is centred on the fact that these are determinants in the game and the referees must develop a great capacity to adapt to the needs of the game (Delaney, Cummings, Thornton & Duthie, 2017). In addition, they are variables that affect the fatigue of referees, regardless of the gender, as they are related to high intensity actions (Hoppe et al., 2017).

## CONCLUSIONS

Pursuant to the results obtained, basketball referees present significant differences according to gender in Acc/min and Dis/min, being higher in women. These results show the importance of analysing the movements of the referee, regardless of gender, to adjust to competition and referees requirements. Furthermore, knowing these variables allows to establish training programs according to the profile of the game.

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