

Physiological Responses of High Performance Netball Umpires During Match Play

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Introduction

In order for elite netball matches to be umpired at the highest standard possible, and therefore have the fairest outcome for players, teams and countries, optimal performance of each individual umpire is extremely important. Performance of umpires in ball sports can be analysed in similar ways to players, however modifications to some of the tools are required as there are no 'on the ball', defensive or attacking movements.

Important aspects of an umpire's performance include movement patterns and physiological indices. To our knowledge, there is no data published on Netball umpires after 1994 (Otago, Riley, & Forrest, 1994); however more recently some studies have analysed netball player movements and physiological demands during competition (Bruce, Farrow, Raynor, & May, 2009; Davidson & Trewartha, 2008; O'Donoghue, Mayes, Edwards, & Garland, 2008). Recent research has also found a need for a netball specific fitness test due to the low validity of the previous protocols (Gasston & Simpson, 2004), this would suggest therefore that a similar analysis of netball umpire performance and testing protocols is also an important area to have research undertaken.

Summary

The purpose of this study was to provide an insight into the physical demands imposed upon High Performance Netball umpires. Many other sports, such as soccer, field hockey, basketball and rugby have acknowledged the vital role of the official and the need to understand the physiological demands of their sport in order for them to perform at their best for longer. The findings of this research are to enable more specific training and goal setting for future High Performance Umpire Squad members

Key Words: elite, GPS, player loading, heart rate

Materials & Methods

- The participants (N = 24) were all members of the Netball New Zealand High Performance Umpire Squad. They umpired at International (n=9), National (n=6) and Development Squad (n=7) level.

Match Day Observations

Match day observations took place over the 2012 Netball Season. All participating umpires wore a Catapult mini-max S4 GPS unit and a Polar Team² HR monitor for the duration of each match observed. Data from these units were captured in real-time and analysed post-match. Each game was filmed, with one camera focussed per umpire for the duration of each match to capture every movement.

For each of the three umpire squads all matches have been combined to give an overall mean for each of the parameters shown below. A total of 59 individual matches are included in these results, with the following breakdown per level/ squad:

- International Squad = 20 matches
- National Squad = 18 matches
- Development Squad = 21 matches
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GPS Software Terminology (Catapult Sprint version 5.1.1)

The following definitions aim to enhance understanding of the data shown in the results section of this report.

Player Load: This term was developed by Catapult and the Australian Institute of Sport to measure exertion or work rate based on the accelerometer data from the GPS units. It is not dependant on distance covered and therefore is a useful way to measure workload when using the indoor mode (where satellite access is unavailable to measure actual distances) and also for non-running activities. There is however a strong correlation between Player Load (PL) and distance covered when the athlete's main activity is running.

Peak Player Load: This is defined as the maximum effort or acceleration (PL) the umpire has sustained for a minimum duration of 1 second during the specified period.

Player Load per minute: This is defined as the mean accumulated Player Load for each time period and indicates umpire intensity.

Equivalent distance: This is the distance covered by each umpire based upon the Player Load variable..

Player Load Band: For the purposes of this research the zones are as follows: Zone (1) 0-1, (2) 1-2, (3) 2-3, (4) 3-4, (5) 4-6 and (6) 6-8.

Zone 1 included the rest/ recovery type movements of standing still, walking forwards, backwards and sideways. Zones 2-6 included the work t movements of jogging, sprinting and side stepping.

Heart Rate Zones: These zones were calculated based on percentage of the peak heart rate (HR_{peak}) as determined by the pre and post-season Fitness Testing for each umpire. Heart rate was catergorised into five zones so that the distribution of exertion could be determined (Weston et al., 2009)

- Zone 1) <60% maximal heart rate
- Zone 2) 60–75% maximal heart rate
- Zone 3) 76–85% maximal heart rate
- Zone 4) 86–93% maximal heart rate
- Zone 5) >93% maximal heart rate

The total time and percentage of total time time in each of the heart rate (HR) zones is reported.

Results

Player Load

Accumulated Player Load, Peak Player Load and Player Load per minute for each quarter and complete game (Figure 1, 2 and 3), including Equivalent Distance (Figure 4), are presented below.

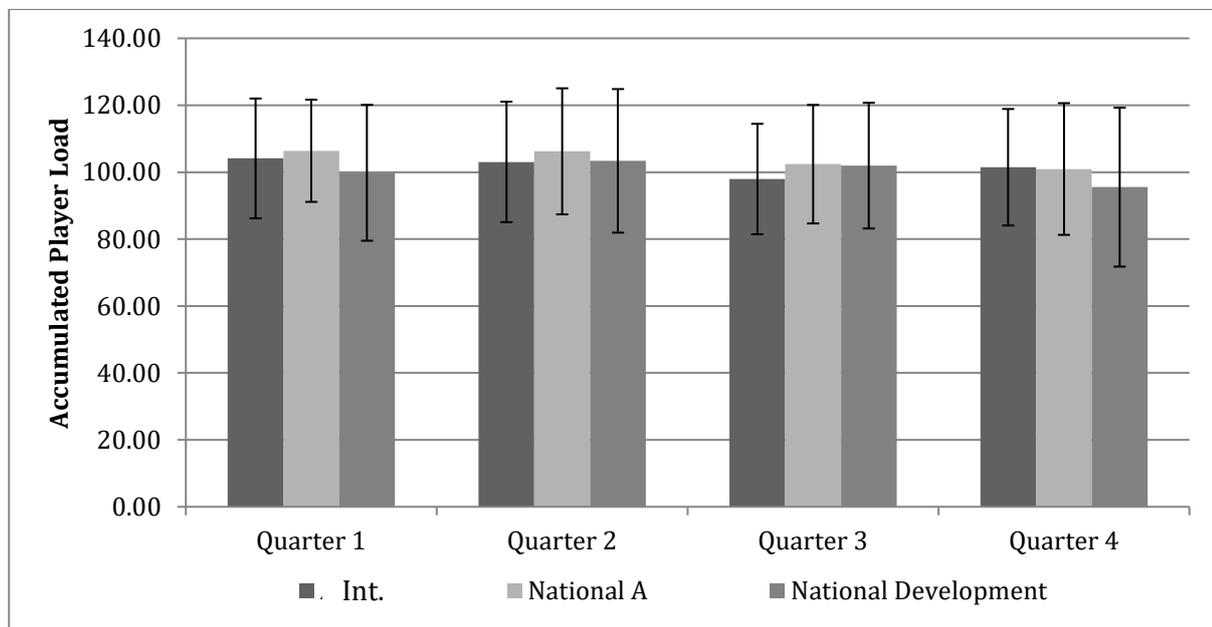


Figure 1. Mean Accumulated Player Load for each quarter of High Performance Umpire Squads 2012.

The total accumulated Player Load is consistent for each umpire level. This suggests that the umpire work rate is similar within in each quarter. This indicates minimal fatigue in the umpires through the duration of the game.

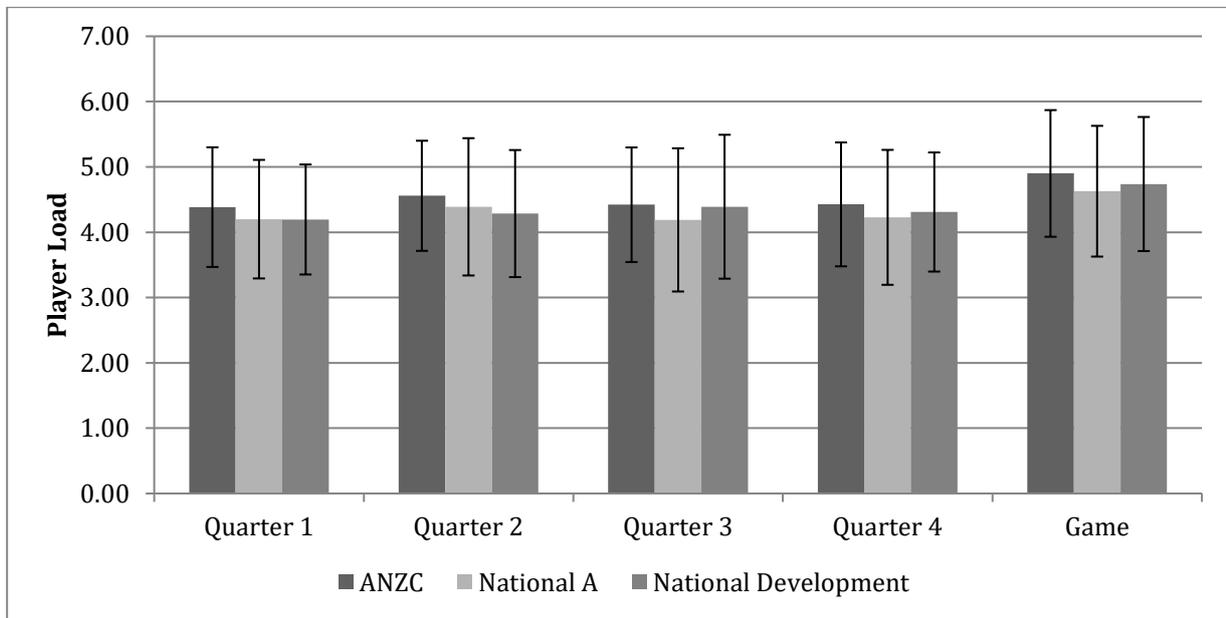


Figure 2. Peak Player Load for each quarter and overall game of High Performance Umpire Squads 2012.

Peak Player Load is an indicator of maximum intensity within each quarter. The ANZ umpires have a consistently higher peak load throughout each quarter than the lower level of umpires. This data also shows that across a full game the peak intensity is similar, and it is also similar across the three squads.

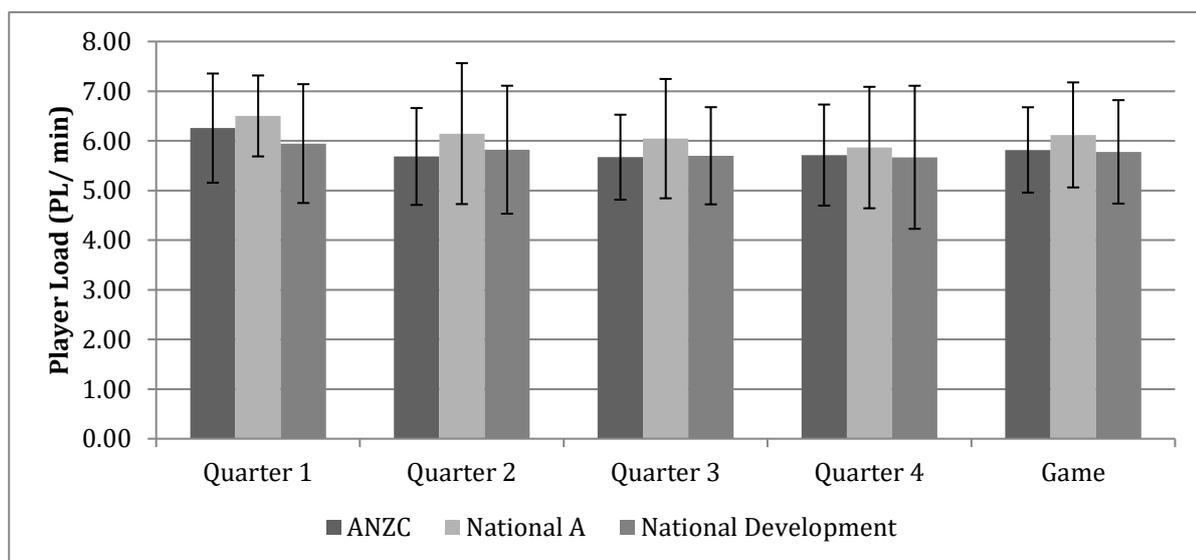


Figure 3. Player Load per minute for each quarter and overall game of High Performance Umpire Squads 2012.

Player Load per minute (PL/min) indicates the intensity within each quarter (Fig. 3) This parameter is useful for looking more closely at the average work rate for the umpires within each quarter, and if this stays the same, increases or decreases across the game . The National squad work on average at a higher intensity across the game as compared to the other two squads. The intensity levels are slightly higher within the first quarter for all squads which shows that the umpires are working slightly harder during this period. This matches what is typically observed in actual players during early stages of many team sports. However there is only a very small decrease in PL/min for each following quarter which also indicates minimal fatigue through the duration of the game.

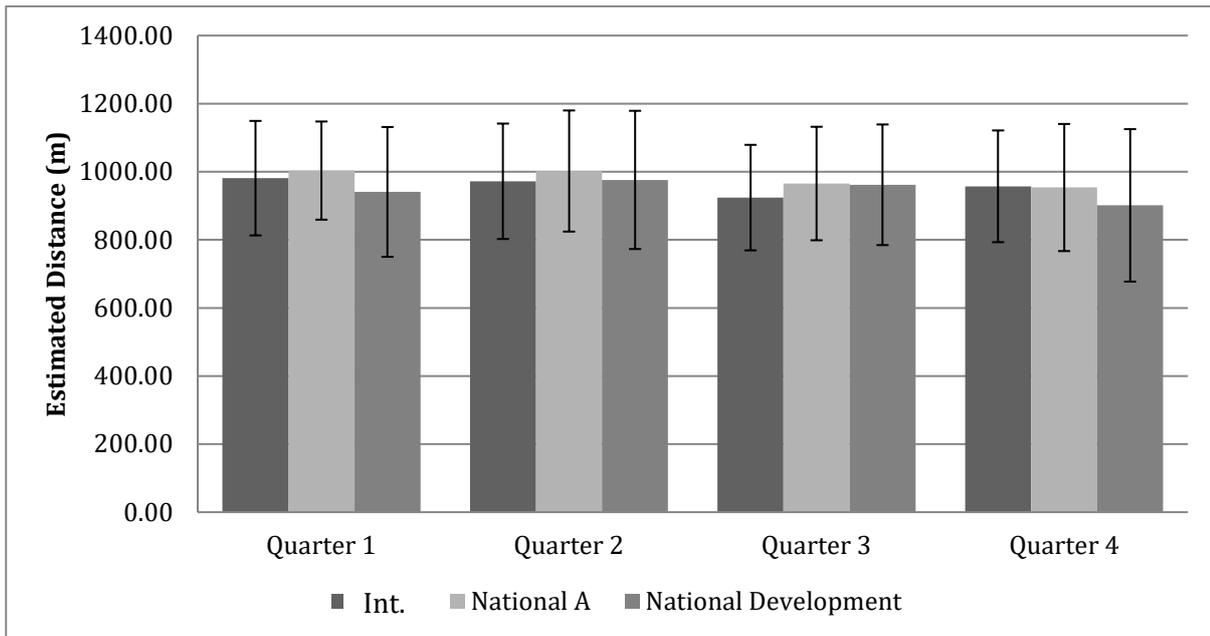
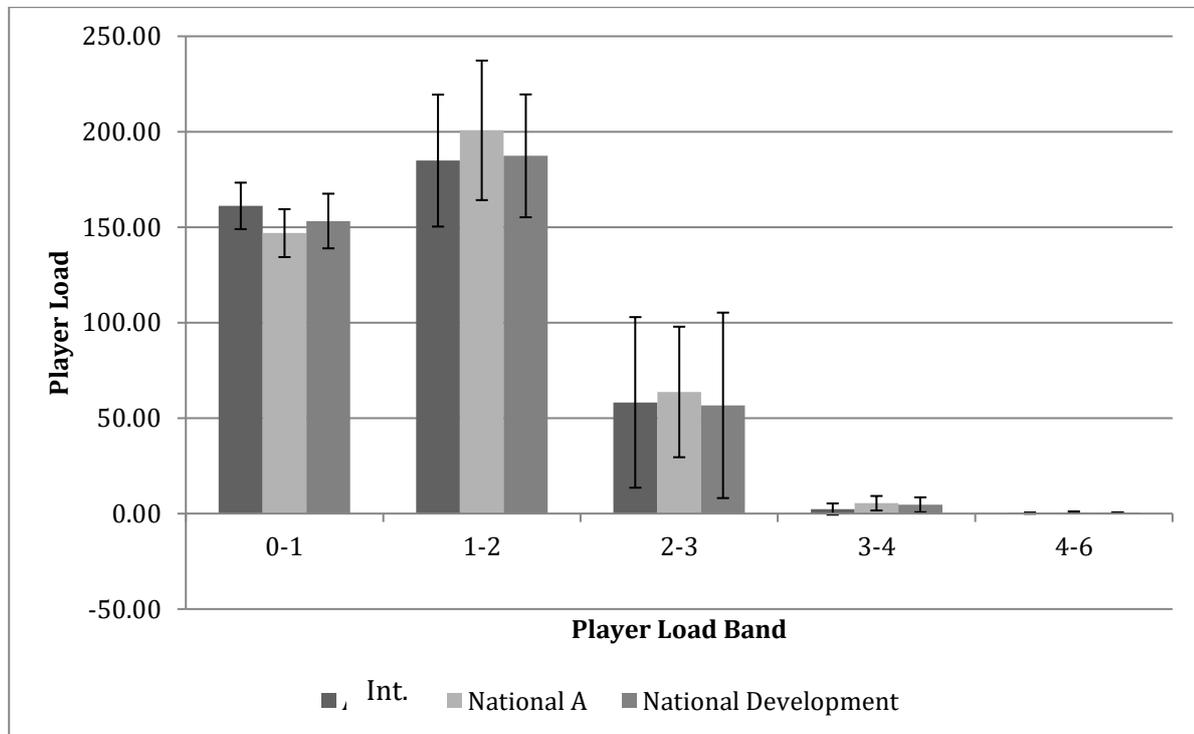


Figure 4. Estimated Distance covered for each quarter of High Performance Umpire Squads 2012.

GPS units do not work indoors so the GPS system adopted estimates an equivalent distance based on player load. The present data shows that similar distances are covered in each quarter, again indicating minimal fatigue in the umpires across a game.

It is useful to break down the Player Loads into the totals accumulated per band so as to see the spread of the different work rates across a game. The amount of time (%) and the estimated distances (% and m) covered shown for each Player Load band will help identify at what intensity is the majority of work completed in.

The total Accumulated Player Load, estimated equivalent distance in metres and as a percentage of the total, and the percentage of time spent in each Player Load band (Figures 5, 6, 7 and Figure 8) are presented below:



Figure

6. Total accumulated player load within each player load band of High Performance Umpire Squads 2012.

It is clear that the majority of physical work done is within the lower two Player Load (PL) bands for all three squads. These two bands cover the main movement types performed by an umpire throughout a match, rest/ recovery movements which are considered standing still and walking and the work type of movement which are jogging, sprinting and side stepping. The higher bands correspond to an increased level of acceleration and are the work type movements performed at faster speeds.

This total accumulated Player Load for each game is split into each band, dependant on the number of times this PL band was reached and stayed within for a minimum of 1 second.

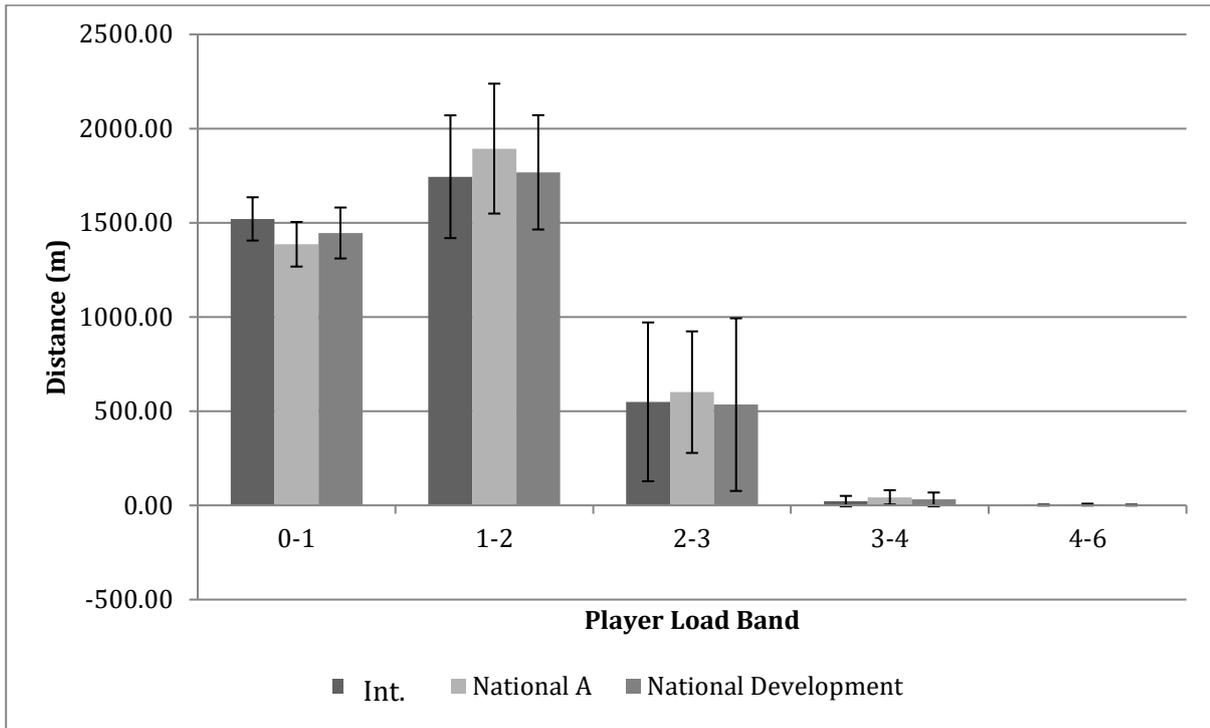


Figure 7. Estimated equivalent distance (metres) per player load band of High Performance Umpire Squads 2012.

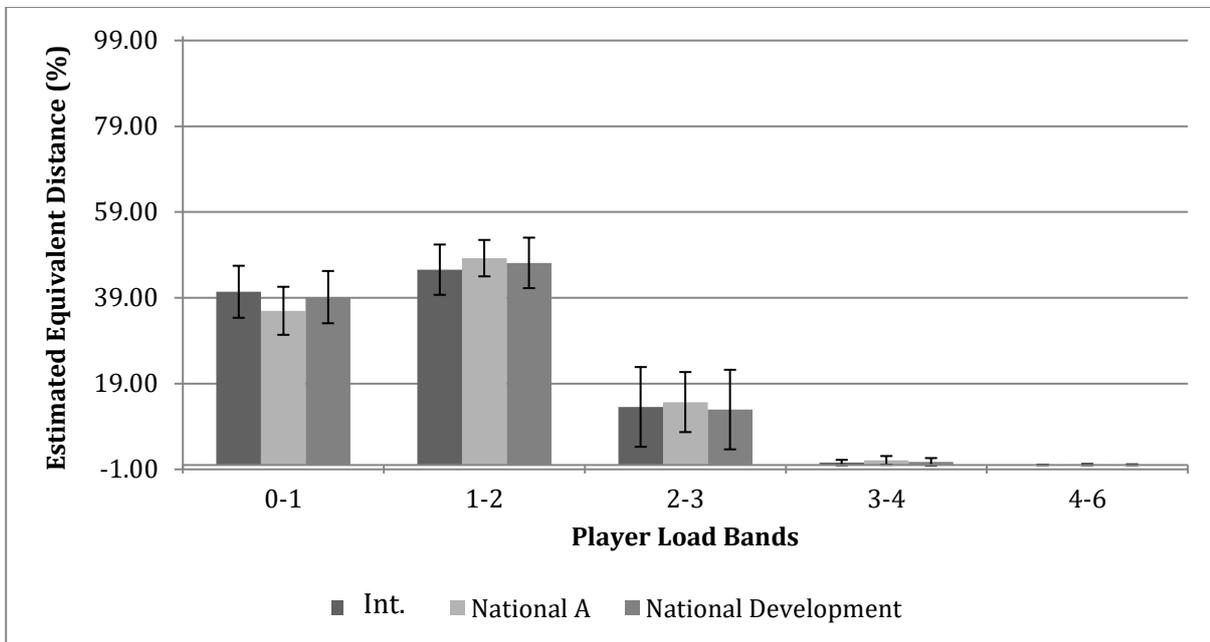


Figure 8. Estimated equivalent distance (%) per player load band of High Performance Umpire Squads 2012.

Similar to player load, a large proportion (45 – 48 %; 1744 – 1893 m) of the total distance covered was in the second to lowest PL Band (1-2) for all three squads, which is only marginally higher than 35 – 40 % (1385 – 1445 m) covered in the lowest PL Band (0-1). This means that the umpires are

covering the majority of ground throughout a match in these lower two bands, with only minimal amount of distance covered at the much higher intensity movements.

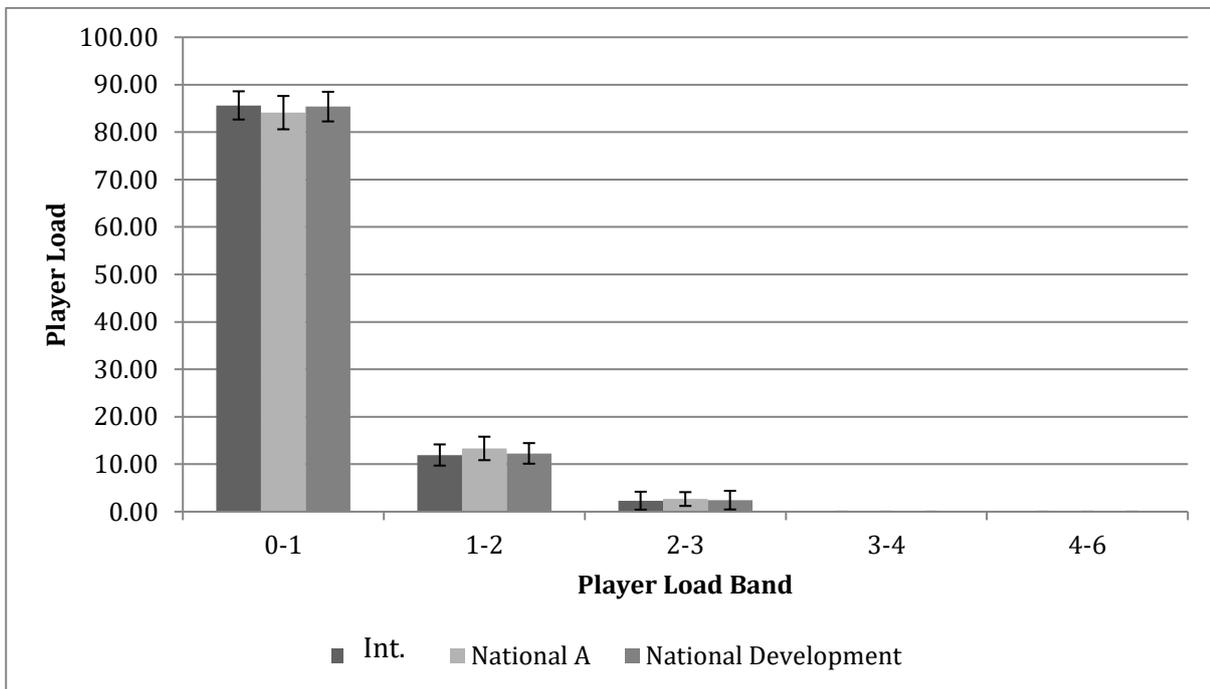


Figure 9. Time (%) spent in each player load band of High Performance Umpire Squads 2012.

The Player Load Band (PL Band) data also confirms that across each of the three levels there is a similar workload. With 84 – 85 % of the total time in a match spent in the lowest PL Band (0-1) for all three squads.

Much less time (11 – 13%) is spent in the second PL band, however the higher intensity that the umpires are working at means that a similar amount of total work is done as per Fig. 6 total accumulated Player Load.

Section Two: Heart Rate

A summary of the percentage of time spent and the average HR within each HR Zone (Figure 10 and 11), are presented below.

Due to bad data (HR only) for four games only 55 out of 59 match data could be used.

- International Squad only 18 out of the 20 games were used.
- National Squad only 17 out of the 18 games were used.
- Development Squad only 20 out of the 21 games were used.

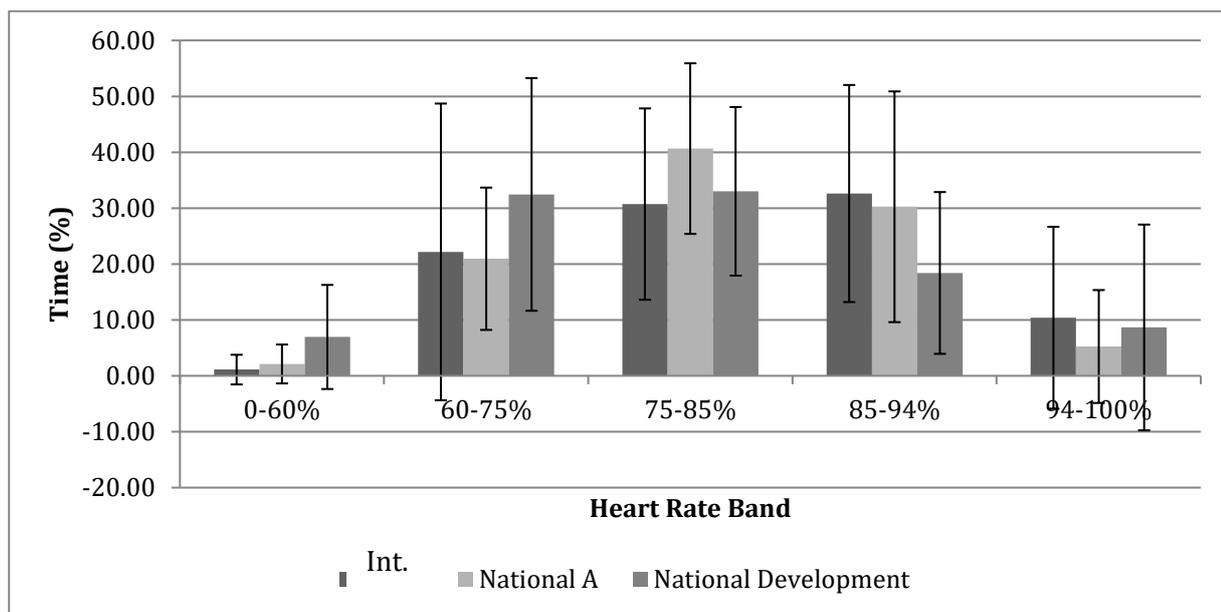


Figure 10. Time spent in each Heart Rate zone as a percentage (%) of High Performance Umpire Squads 2012.

The HR data shows the greatest variation across the three levels of umpires, with the International squad working at a higher percentage of PeakHR than the other two squads, and the Development squad working at a lower percentage of PeakHR in comparison.

The National squad spent the greatest amount of time working in the middle HR zone of 75 – 85 % of PeakHR.

All three levels/ squad spent minimal time at either end of the five HR zones, with overall the most time spent at 75 – 85 % of PeakHR. The Development squad spent approximately 12% less time than the other two squads in the 85 – 94% zone, which means they worked at a slightly lower intensity throughout their matches as compared to the other two squads.

Discussion

Match-play data

- Player Load per minute as an indicator of intensity shows a greater intensity in the first quarter, with a slight decrease across the following three quarters.
- Total accumulated Player Load, Distance (mean and percent) and Peak Player Load are all similar across each quarter and therefore indicate a similar workload across the whole game with minimal fatigue.
- The majority of the estimated distance covered is at a workrate that falls into the lower two Player Load bands.
- The greatest amount of time is spent on activity in the lowest Player Load band.
- The majority of time throughout a game is spent in between 75 – 85 % of Heart Rate Peak.

Conclusion

Overall the match-play data show minimal difference between the squads with regards to the intensity that they maintain within a game. It also shows minimal fatigue for all three squads throughout the duration of a game.

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