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Research Article

Use of RPE for Monitoring Intensity Throughout Collegiate Basketball Drills

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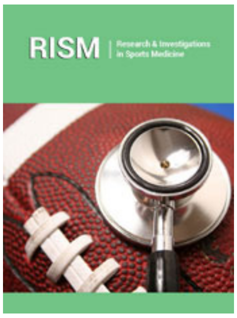

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Abstract

The ability to control and monitor the perception of training load is an important aspect of effective coaching.

Purpose: To examine the relation between OMNI ratings of perceived exertion and MET levels of intensity measures throughout a series of collegiate basketball drills.

Methods: 16 collegiate female basketball players (age 19.2±1.2 years) participated in this investigation. Participants engaged a 30-minute basketball skills session. The 30-minute basketball workout was created to simulate the high intensity environment of a Division I practice or game. Drills were selected to reflect the major skills needed to play the game of basketball. Each drill was also chosen because of its widespread use in the college basketball setting. The drills included progressive defensive slides, half court speed lay-ups, the Mikan drill, half court dribbling drill, toss out shooting drill, medicine ball plyometrics, and conditioning sprints (Victories). Intensity of activity was determined using METS obtained from measures of oxygen uptake determined via the Indirect Calorimetry (IC) method (Cosmed K4 B^2) ($ml \cdot kg \cdot min^{-1}$). The Adult OMNI Walk/Run Perceived Exertion scale was used to assess the subjects rating of perceived exertion for overall body, chest/breathing, and legs (RPE-O, RPE-C, RPE-L). Subjects were familiarized to the scale during an orientation session and prior to the experimental trial. RPE was obtained during the 60-second transition period between each drill. Pearson correlation coefficients compared RPE and MET level for each of the drills in the experimental trial ($p<.05$).

Results: Individual correlations between the MET level of various basketball drills and RPE showed a strong positive relationship with several drills (from $r=0.50$ to $r=0.85$, $P<0.05$). Progressive Defensive slides, Speed Lay-ups, the Mikan drill, and Victories were all statistically significant.

Conclusion: Results suggest that RPE may be considered a good indicator of perceived training intensity in various basketball drills. This method can be very useful and easy to use for coaches and athletic trainers to monitor and self-regulate exercise intensity, and to design season training loads.

Introduction

The ability to individually control and monitor training load and the perception of training load is an important aspect of effective coaching [1]. Monitoring training intensity is also a critical component to the process of creating an individualized periodization focused training plan. Having the ability to effectively quantitate training load for various exercises and drills using a single term would be very useful in overall ease of program understanding and administration. There have been attempts at quantitating training from "aerobics points" [2] and training volume [3] to the training impulse [4]. These methods have supporting factors and limitations that make them difficult to implement in a team sport with intermittent intensities. Given the importance of both high intensity training and variable training bouts for athletes of the intermittent nature. Information regarding the practicality and accuracy of the Omni Ratings of Perceived Exertion (RPE) method during exercise in sports specific scenarios could be valuable for coaches and trainers. RPE is an easy to use tool for measuring intensity during physical activity. Therefore, the intent of this study was to evaluate the relationship of the RPE and Indirect Calorimetry (IC) (METs) based methods of monitoring training intensities during drills with varying intensity to emulate game like conditions. To examine the relation between OMNI ratings of perceived exertion and MET levels of intensity measures throughout a series of collegiate basketball drills.

Methods

Participants

Sixteen women's college basketball players (aged 18-23 years) who were currently participating in basketball and conditioning activities participated in this investigation. Specifically, eight females from the University of Pittsburgh and eight from Carnegie Mellon University volunteered as subjects in the present study. All participation was strictly voluntary. The study did comply with NCAA regulations, and had the support and approval of the University of Pittsburgh and Carnegie Mellon University Department of Athletics, head women's basketball coaches, and head strength and conditioning coaches. The racial, gender, and ethnic characteristics of the subject population reflected the demographics of female basketball players recruited to participate in NCAA Division I and Division III women's basketball. Descriptive characteristics are explained in Table 1. In order to participate, subjects were:

Table 1: Descriptive characteristics of subjects.

	Pitt (n=8)	CMU (n=8)	Guards (n=10)	Forwards (n=6)	Combined (n=16)
Age (yrs)	18.9±1.1	19.5±1.2	19±1.1	19.5±1.4	19.2±1.2
Weight (kg)	75.5±17.2	75.6±8.1	70.4±9.9	84.3±13.5	75.6±12.9
Height (cm)	178.6±9.1	176.3±5.6	172.6±3.2	185.5±4.4	177.4±7.4
BMI ($kg{\cdot}m^2$)	23.4±3.5	24.5±3.4	23.7±3.7	24.3±3.1	23.9±3.4
Body Fat (%)	23.3±3.5	24.1±5.9	24.3±5.5	22.6±3.4	23.7±4.7

University of Pittsburgh (Pitt) and Carnegie Mellon University (CMU). Values are presented as Mean ± Standard Deviation.

1. Healthy;
2. Currently eligible for college athletics;
3. Able to complete an orientation and two experimental trials.

Exclusion criteria for the study included

1. Responding, "yes" to one or more questions on the physical activity readiness questionnaire (PAR-Q);
2. Presence of any orthopedic, musculoskeletal, neurological, cardiac, and/or any medical conditions that prohibit exercise;
3. Presence of diabetes, hypothyroidism, or any other medical conditions that would affect energy metabolism;
4. Reported use of medications or any performance enhancing drugs that may have affected heart rate, blood pressure, metabolism, and/or EE responses;
5. Knowingly pregnant or pregnant within the last 6 months;
6. Unwilling to perform or participate in two basketball experimental trials.

Protocol

i. Experimental session: Following the orientation session subjects were asked to abstain from caffeine intake for four hours. All subjects were dressed in standard athletic clothing (short sleeve cotton t-shirt or mesh practice jersey and shorts) during each exercise session. Each subject was tested individually [3]. Upon arrival to each experimental trial, anthropometric measures were obtained including height (cm), body weight (kg), fat free mass (kg), and fat mass (% and kg). Height (cm) and weight (kg) were measured using a physician's scale. Body composition was assessed using a Tanita (Arlington Heights, IL) Bioelectrical Impedance Analyzer (BIA) scale. Subjects then went through a 30-minute Basketball specific workout [4].

ii. 30-Minute basketball workout: The athlete performed a 30-minute basketball specific workout. The 30-minute basketball workout was created to simulate the high intensity environment of a collegiate practice or game. The drills were selected to reflect the major skills needed to play the game of basketball. Each drill was also chosen because of its widespread use in the college basketball setting. The drills included progressive defensive slides, half court speed lay-ups, Mikan drill, half court dribbling drill, toss out shooting drill, medicine ball plyometrics, free throws, and conditioning sprints.

iii. Rating of perceived exertion: The Adult OMNI Walk/Run Perceived Exertion scale was used to assess the subjects rating of perceived exertion for overall body, chest/breathing, and legs (RPE-O, RPE-C, RPE-L) during the experimental trial. RPE is defined as the subjective intensity of effort, strain, discomfort and/or fatigue that is felt during exercise [5], Ratings of Perceived Exertion (RPE) have been determined to be both reliable and valid [5]. Measurement of RPE involves using numerically based category scales that allow a subject to select a number that corresponds to the intensity of their perception of physical exertion. Subjects were familiarized to the scale during the orientation session and prior to each experimental trial. RPE was obtained for overall body, chest, and legs during the 60-second transition period between each drill during the 30-minute basketball skills session.

iv. Statistical analysis: Statistical analyses were performed using IBM SPSS Statistics (Version 20.0) with level of significance set at $p<0.05$. Descriptive characteristics of subjects are presented as means ± standard deviations (Table 1). Descriptive statistics were computed for demographics, BMI, and %body fat. Pearson correlation coefficients compared RPE and MET level for each of the drills in experimental trial.

Result

Physiological and Perceptual Characteristics along with Descriptive characteristics for the drills used during the 30-minute basketball session are provided in Table 2. For each drill the mean VO2 (ml·kg·min^{-1}), % of VO2 peak (Cosmed measure from 20-meter shuttle run test), METs, and heart rate (b·min^{-1}) were measured (Table 2). Perceived exertion for the overall body (RPE-O), chest (RPE-C), and legs (RPE-L) were also obtained at the end of each drill (Table 2). Individual correlations between the MET level of various basketball drills and RPE (Table 3) shows a strong positive relationship with several drills (from r=0.50 to r=0.85, P<0.05). Progressive Defensive slides, Speed Lay-ups, the Mikan drill, and Victories were all statistically significant. The results of the study indicate a strong relationship between exercise intensity measured in RPE (O, L, C) and intensity measured in METs for 4 out of the 7 drills used. Results also indicate a stronger relationship in drills of a higher Intensity.

Table 2: Physiological and perceptual characteristics of basketball drills.

Drills	VO_2 (ml·kg·min^{-1})	METs	kcal·min^{-1}	HR(b·min^{-1})	RPE-O	RPE-C	RPE-L
Progressive Defensive Slide	28.9 ± 3.9	7.98 ± .93	10.72 ± 3.6	165.2 ± 13.4	5.7 ± 1.3	5.4 ± 1.6	5.5 ± 1.5
Mikan	27.8 ± 3.4	8.05 ± .93	11.17 ± 2.19	170.7 ± 10.7	5.1 ± 1.5	5.0 ± 1.8	4.8 ± 1.8
Speed Lay-Up	28.6 ± 3.3	8.32 ± .91	11.18 ± 2.61	173.5 ± 9.2	6.6 ± 1.2	6.4 ± 1.6	6.4 ± 1.4
Victory	29.1 ± 3.6	8.41 ± 1.1	11.58 ± 2.38	177.8 ± 8.9	7.8 ± 1.0	7.7 ± 1.3	7.5 ± 1.5
Free Throw (1)	19.3 ± 3.8	5.9 ± 1.2	7.96 ± 1.77	163.9 ± 15.9	2.5 ± 2	2.6 ± 1.9	2.3 ± 1.9
Medicine Ball Plyometrics	20.0 ± 4.1	6.4 ± 1.2	8.21 ± 2.01	155.2 ± 13.1	3.7 ± 1.7	3.3 ± 1.8	2.8 ± 1.9
½ Court Dribbling Drills	25.0 ± 6.4	7.7 ± .86	10.14 ± 2.02	172.5 ± 10.8	5.3 ± 1.4	4.9 ± 1.9	5.1 ± 1.8
Toss Out Shooting Drill	24.9 ± 2.7	7.2 ± .86	9.65 ± 1.7	172.1 ± 10.8	3.9 ± 1.1	3.6 ± 1.7	3.7 ± 1.4
Free Throws (2)	19.1 ± 3.2	5.2 ± .86	6.79 ± 1.58	144.1 ± 57.4	1.7 ± 1.4	1.9 ± 1.7	1.6 ± 1.5

Values are presented as Mean ± Standard Deviation.

Table 3: Relationship of Mets and RPE for basketball drills.

Drill	RPE-O	RPE-C	RPE-L
Progressive Defensive Slides	r=0.661*	r=0.652*	r=0.640*
Speed Lay-Ups	r=0.772*	r=0.743*	r=0.724*
Mikan Drill	r=0.844*	r=0.823*	r=0.811*
Half Court Dribbling	r=0.681	r=0.621	r=0.655
Toss-out Shooting	r=0.552	r=0.561	r=0.513
MB Plyometrics	r=0.501	r=0.522	r=0.512
"Victories"	r=0.849*	r=0.861*	r=0.823*

Discussion

Overall the results suggest that RPE may be considered a good indicator of perceived training intensity in various basketball drills. The results of this study are consistent with previous studies [2,5,6]. The overall consistency between objective (METs) and subjective (RPE) methods of monitoring training during exercise suggest the use of RPE as an accurate subjective measure of intensity during non-steady state exercise. Because the team sport of basketball can be characterized by intermittent exercises relying on both aerobic and anaerobic sources for energy provision, the different perceived exertion with similar MET levels may help to explain the reduced strength of the correlations between exercises with a lower overall intensity level. The more taxing the drill the higher the correlation between METs and RPE appeared to be.

As RPE represents the athlete's own perception of training intensity, which can include both physical and psychological stress. Previous research suggests that RPE may be a more reliable measure of exercise intensity when both anaerobic and aerobic systems are activated, such as is the case during intermittent activities like basketball training. Hence, these findings emphasize the usefulness of RPE to monitor exercise intensity due to its psychobiological nature [7].

Although RPE has been shown to accurately reflect exercise intensity, a possible limitation of this method for measuring intensity could be the psychological state of the athlete [1]. Players could perceive the same physiological stimulus differently as a consequence of their individual psychological state [5]. Investigations into overreaching and overtraining have shown an increase in RPE with an increased fatigue state [5]. Other limitations of the study may include small sample size and a small sample of basketball specific drills evaluated. Future studies can explore whether variations in drills selected and gender play a role in the relationship between RPE and METs. The use of RPE for assessment of intensity during practice could have implications for improving workout/program design, assessment of recovery needs, training needs, and training intensities.

Conclusion

In summary, based on our results and the literature reviewed, Omni RPE seems to be a good indicator of drill specific training load. This method does not require expensive equipment and can be easily implemented. The use of RPE can be very useful and easy to use for coaches and athletic trainers to monitor and allow athletes to self-regulate exercise intensity. This method for athletes could also be expanded for use with training loads for in season and off-season program design. Furthermore, the present results suggest that the RPE-based method may assist in the development of specific periodization strategies for individuals and teams. This straightforward method has the potential to become a valuable tool for coaches and sport scientists to monitor exercise intensity, but further studies are necessary to fully validate strategy [8-14].

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