



# The Relationship between Objective and Subjective Markers of Training Stress in NCAA Division I Collegiate Basketball Players

Casey L. Pederson, Courtney D. Elliott, James R. Hutson, and Dustin P. Joubert

Human Performance Lab; Department of Kinesiology and Health Science; Stephen F. Austin State University; Nacogdoches, TX



## Abstract

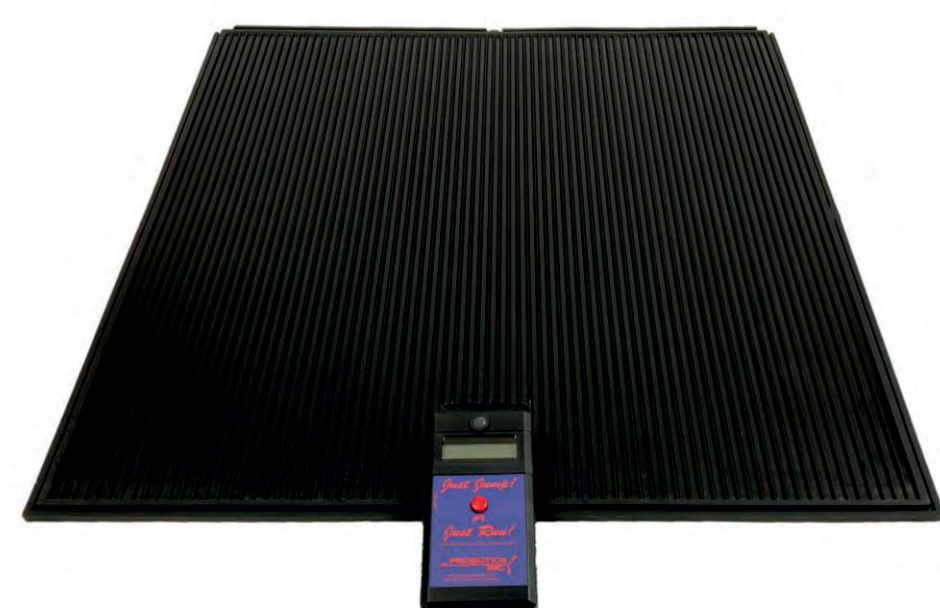
An athlete's training stress score (TSS) is an objective marker of overall training volume and can be determined by tracking total time spent at specific heart rate (HR) zones. Additionally, an athlete's power factor (PF) or explosive strength is an important marker of performance and can be measured objectively with power testing equipment. While these measures of training stress and performance are important, a coach with limited resources may not have access to the equipment or expertise to measure these variables. On a subjective level, perceived recovery status (PRS) prior to practice and the rating of perceived exertion (RPE) during a practice can be used to measure stress of training. While the relationship between these objective and subjective markers of training stress have been studied in endurance sports, less descriptive data is available for these responses in intermittent, team sports. We decided to base our research on women's basketball athletes due to the lack of studies for this demographic. **Purpose:** To determine the relationship between PRS and PF, PRS and TSS, and PRS and RPE in NCAA Division I female basketball athletes. **Methods:** Data was collected over several weeks during both the off-season and competition season in 12 NCAA Division I women's basketball players. Prior to practices at the end of the week, their PF was measured by performing a 4-jump test on a jump mat. Increased PF values indicate more explosive strength. The players also indicated their subjective rating of recovery on the PRS index before practice with higher values indicating the player felt more recovered. RPE was measured after each practice as a rating of how hard the player felt practice was with higher values indicating a more stressful practice. Finally, their TSS was calculated for the entire week by measuring their heart rates and time spent in specific HR zones. The relationship between PRS-PF, PRS-TSS, and PRS-RPE was then calculated by Pearson correlations. **Results:** Comparing PRS- PF, there was a weak positive correlation ( $r = .305$ ) on average for the team, while seven of the twelve players (58%) had at least a moderately positive correlation ( $r > .4$ ). PRS-TSS displayed a very weak negative correlation ( $r = -.077$ ). PRS-RPE showed a very weak positive relationship ( $r = .141$ ). **Conclusion:** We hypothesized that as the athlete felt more recovered (higher PRS), their explosive strength measured by the jump test would also increase (higher PF). Over half of the players observed could provide an accurate subjective measure of how prepared they were for practice that correlated with their actual explosive strength prior to practice. For these athletes, the PRS might be a useful surrogate to daily power testing. This would allow the coach to adjust practice accordingly without the need for special equipment or additional testing. While examining the other relationships, PRS vs TSS and PRS vs RPE, we did not see a strong relationship in either. This might indicate that quantifying training stress by HR measurement may not be easily replaced by subjective measures.

## Introduction

- Training Stress Score (TSS) is an objective marker of training volume that can be determined by tracking the total time spent in specific heart rate zones.
- Power Factor (PF) is a marker of explosive strength and important marker of performance that can be measured with power testing equipment.
- With limited resources a coach may not be able to measure these variables.
- Perceived recovery status (PRS) and rating of perceived exertion (RPE) are subjective measures that can be used prior to and during practice to measure preparedness and training stress, respectively.
- Lack of research on the relationship between these subjective and objective markers of training stress in team sports, particularly women's basketball.
- Therefore, the purpose of this study was to determine the relationship between PRS and PF, TSS and PRS, and PRS and RPE in NCAA Division I female basketball athletes.

## Methods

- Subjects: 12 NCAA Division I women basketball players
- Prior to practice subjects measured their PF by performing a 4-jump test on a jump mat and indicated their rate of recovery/preparedness on the PRS index
- RPE was measured after practice at the end of the week based on how difficult the player perceived practice
- TSS was calculated for the entire week using heart rate monitors to measure their heart rates and the time spent in specific HR zones
- The Pearson correlation between PRS-PF, PRS-TSS, PRS-RPE, and TSS-RPE was calculated for each player and averaged for the team overall.



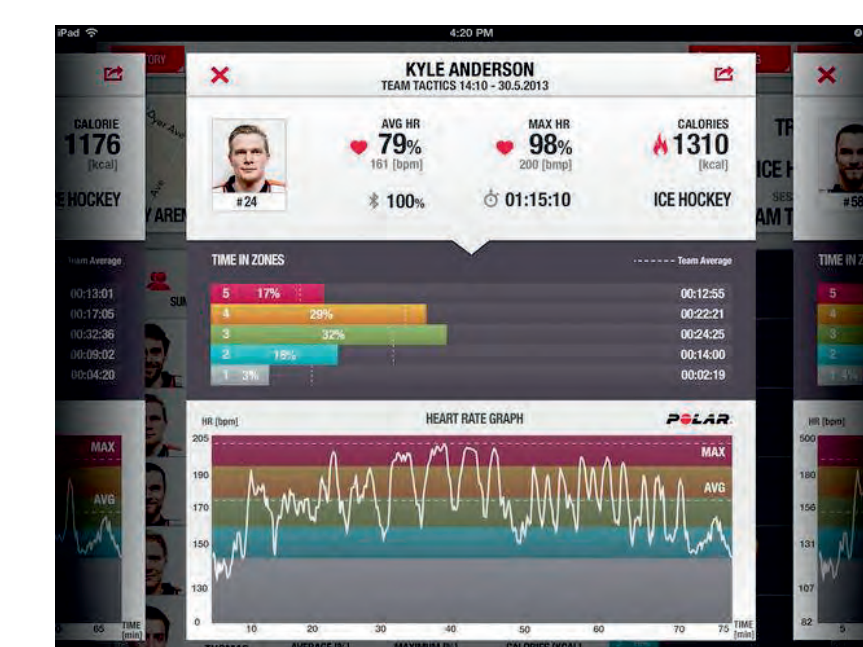
Just Jump - Power Testing Mat

Perceived Recovery Status Scale		
10	Very well recovered / Highly energetic	Expect Improved Performance
9	Well recovered / Somewhat energetic	
8	Well recovered / Somewhat energetic	
7	Moderately recovered	Expect Similar Performance
6	Adequately recovered	
5	Somewhat recovered	
4	Somewhat recovered	Expect Declined Performance
3	Not well recovered / Somewhat tired	
2	Not well recovered / Somewhat tired	
1	Very poorly recovered / Extremely tired	
0	Very poorly recovered / Extremely tired	

Perceived Recovery Status Scale

BORIS SCALE Rating of Perceived Exertion	
6	
7	Very very light
8	
9	Very light
10	
11	Fairly light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Vary hard
18	
19	Very very hard
20	

Rating of Perceived Exertion



Polar Team App

## Results

- PRS-PF had a weak positive correlation ( $r = .305$ ) on average for the team; however, when looking at individual subjects, seven of the twelve (58%) had at least a moderately positive correlation ( $r > .4$ )
- PRS-TSS displayed a very weak negative correlation ( $r = -.077$ )
- PRS-RPE showed a very weak positive correlation ( $r = .141$ ), as did TSS-RPE ( $r = .085$ ).

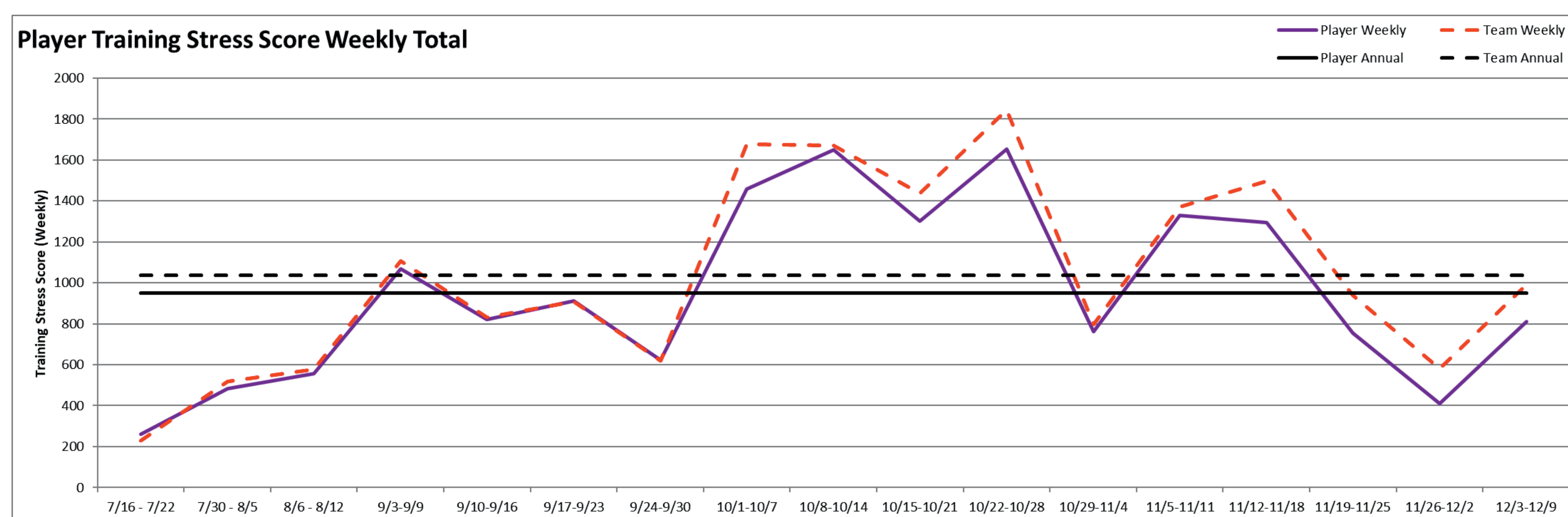


FIGURE 1 – Sample of a player's weekly TSS compared to the team average TSS

## Conclusions

- Over half of the players observed could provide accurate subjective measures of how recovered they were for practice (PRS) that correlated with their actual explosive strength (PF) prior to practice.
- These athletes might be able to use the PRS index as an surrogate to daily power testing, allowing coaches to adjust accordingly prior to the start of practice and according to the athletes needs without using special equipment or additional testing.
- The relationships between PRS vs TSS, TSS vs RPE, and PRS vs RPE did not show a strong relationship which may indicate that measuring training stress by HR measurement may not be easily replaced by subjective measures.