

# Training Load and Performance in Collegiate Volleyball

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## ABSTRACT

**PURPOSE:** The aim of this study was to compare player load (PL), total jumps, and wellness across different phases of the volleyball season. **METHODS:** Data were collected from eighteen collegiate athletes from a Division 1 university during the 2021-2022 season. Of the 18 players, 6 were classified as defensive specialists, 4 middle blockers, 6 outside hitters, and 2 setters. Athletes wore tri-axial accelerometers (ClearSky T6, Catapult Sports, Melbourne Australia) during all team related activities to track movement and intensities in all three planes of motion. PL was calculated for each activity by taking the sum of instantaneous acceleration in all three planes of motion divided by 100. Wellness was measured via a daily subjective questionnaire (Kinduct, Halifax, Canada) that participants completed each morning via mobile device. Questions focused on mood state, sleep quality, sleep duration, energy level, muscle readiness, diet yesterday, and academic pressure. Every question except sleep duration was evaluated on a scale of 1-5, with 1 being the worst and 5 the best. For sleep duration, the number of hours of sleep obtained the previous night was recorded. Separate linear mixed model regressions using least square means were used to examine each accelerometer and wellness variable of interest. The model was then examined to determine if differences existed across pre-, in-, and post-season time points. The data was analyzed using R statistical software (R Core Team, Vienna Austria) and the level of significance was set at  $P \leq 0.05$ . **RESULTS:** The results can be found in Table 1. All accelerometer variables were higher during the pre-season compared to in- and post-season. No differences were observed between in- and post-season ( $p=0.098$ ). Muscle readiness scores were lower (worse) during the pre-season compared to in- and post-season, but no differences between in-season and post-season were observed. Academic pressure scores were highest (less academic stress) during the pre-season and lowest (more academic stress) during the post-season. **CONCLUSIONS:** The combination of higher training loads and worse wellness scores in the pre-season may be the result of greater practice volume and intensity as teams prepare for the upcoming season. As the season continued, training volume leveled off, and athletes became more adapted which led to better wellness scores. **PRACTICAL APPLICATIONS:** Knowing the seasonal trends in accelerometer and wellness variables will allow strength and conditioning coaches to appropriately tailor training volumes and intensities to prevent overtraining and keep athletes performing at the highest level.

## Introduction

- Increases in technology have allowed training load monitoring to be more accessible for all sports
- Training load seems to be the greatest during the pre-season in field-based sports<sup>1,2</sup>
- Lack of evidence about how training load changes across the season in volleyball
- Wellness questionnaires detect changes in social, psychology, and physical wellness, all of which play an important role in overall wellness and performance<sup>3</sup>

## Purpose

The aim of this study was to compare player load (PL), total jumps, and wellness across different phases of the volleyball season

## Methods

### Subjects

- 18 Collegiate Volleyball Players (6 defensive specialists, 4 middle blockers, 6 outside hitters, 2 setters)
- Data was collected during the 2021-2022 season

### Procedures

Athletes wore tri-axial accelerometers during all team related activities

- Player Load
- Total Jumps

Wellness measured with daily subjective questionnaire evaluated on a 1-5 scale.

- Mood State
- Sleep Quality
- Sleep Duration
- Energy Level
- Muscle Readiness
- Diet Yesterday
- Academic Pressure

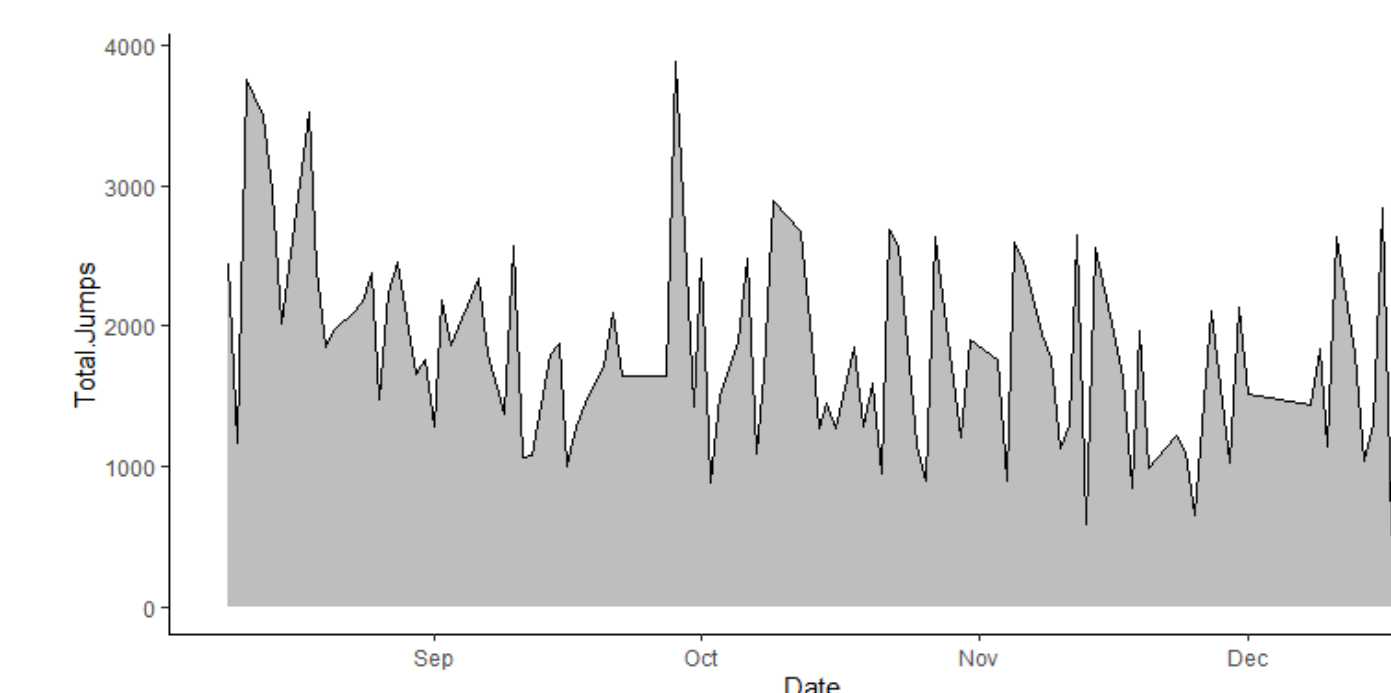


Figure 1. Total jumps across the season for the team

### Data Analysis

Separate linear mixed model regressions using least square means were used to examine each accelerometer and wellness variable of interest.

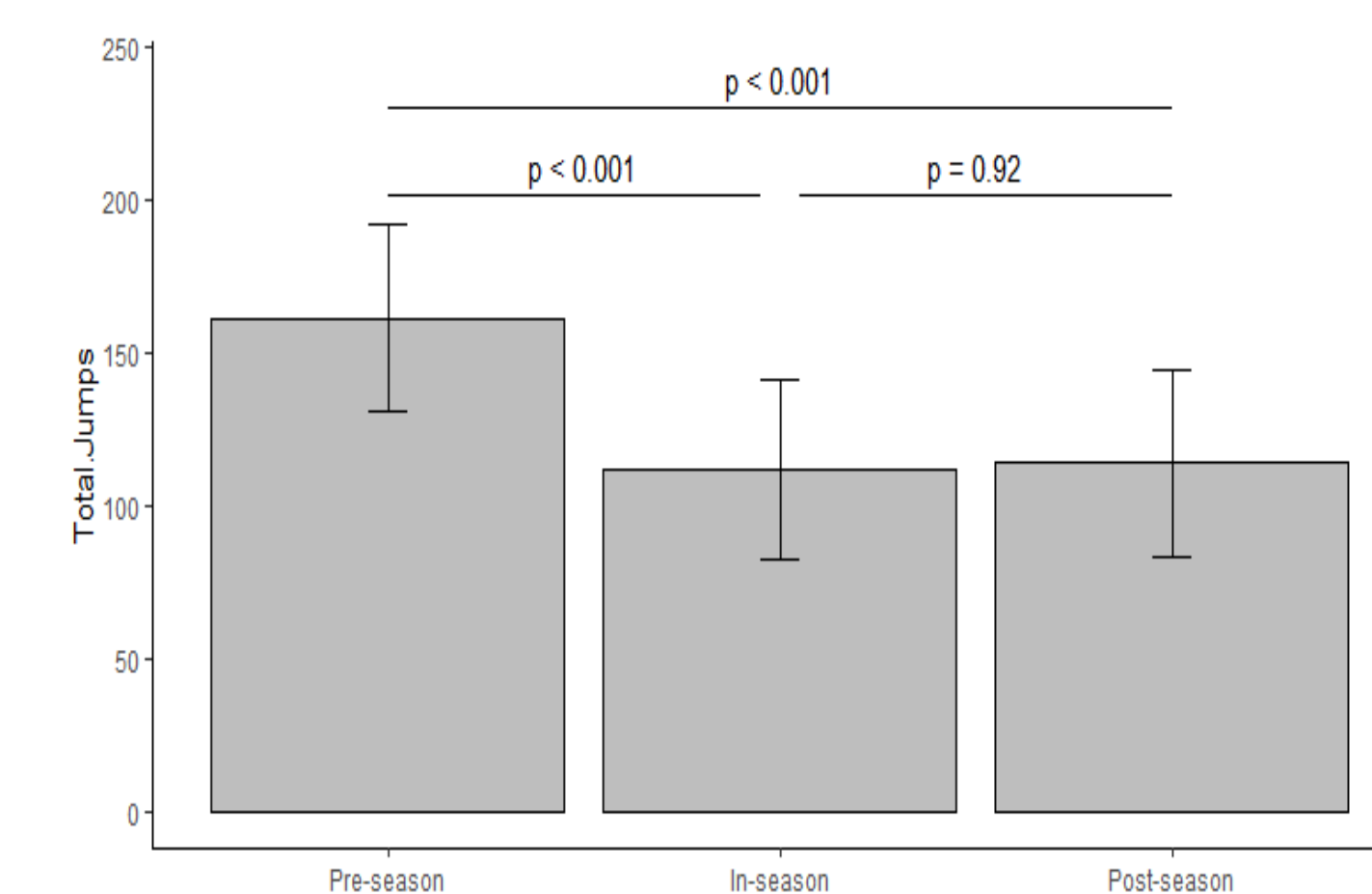


Figure 2. Total jumps differences between seasons

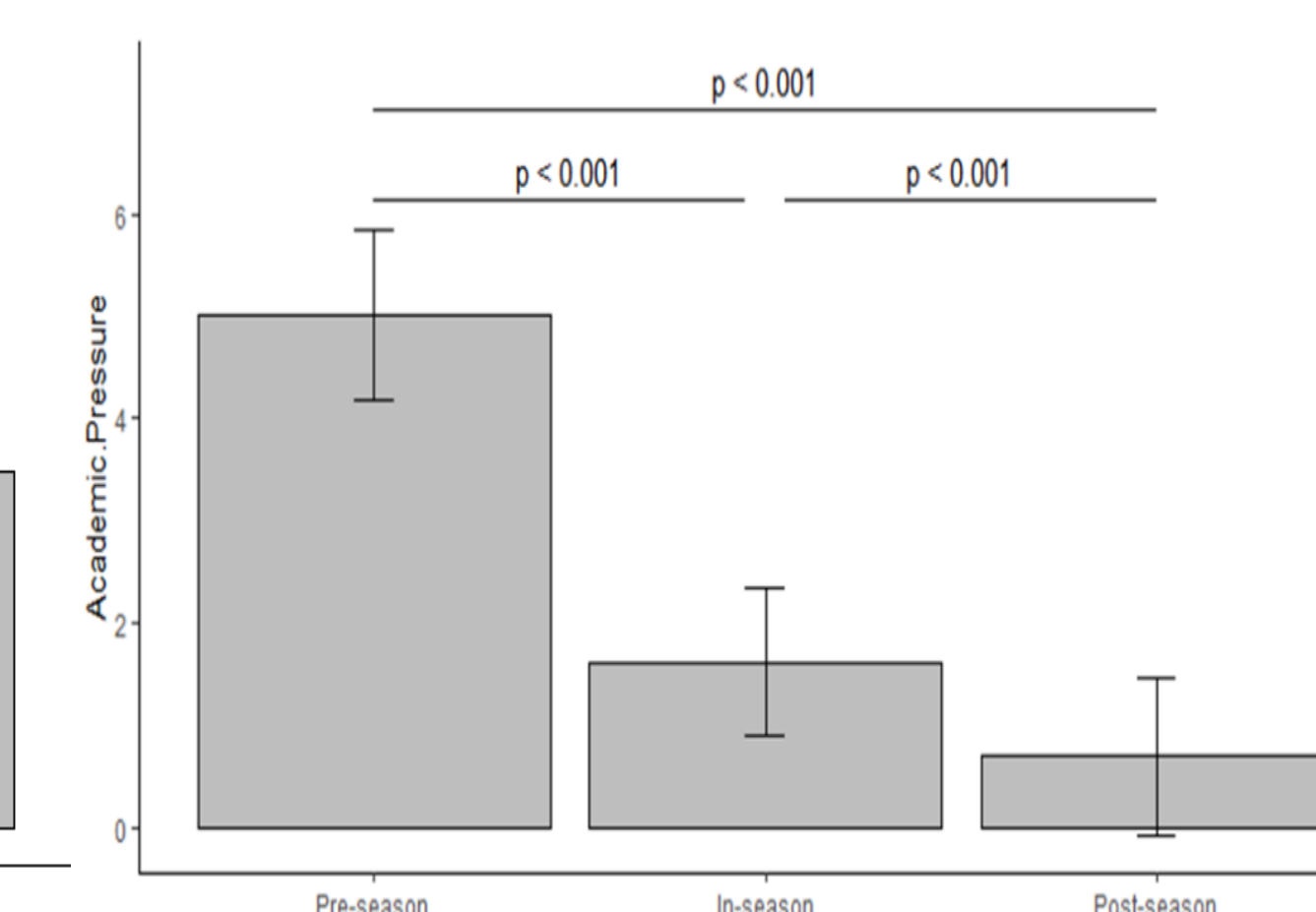


Figure 3. Academic Pressure differences between seasons

## Results

- Accelerometer variables (total jumps and player load)
  - pre-season > in-season and post-season
- Muscle Readiness
  - pre-season < in-season and post-season
- Academic Pressure
  - pre-season (less academic stress) < post-season (more academic stress)

Table 1. Descriptive statistics using accelerometry and wellness variables for each season

|                      | Pre-Season |         | In-Season  |         | Post-Season |           |
|----------------------|------------|---------|------------|---------|-------------|-----------|
|                      | Mean±SE    | CI      | Mean±SE    | CI      | Mean±SE     | CI        |
| Total Player Load*   | 701.6±24   | 654,748 | 524.7±16.4 | 489,559 | 529.9±24.1  | 480,576   |
| Total Jumps*         | 161.1±14.5 | 131,192 | 111.8±13.9 | 83,141  | 113.8±14.5  | 83,144    |
| Sleep Duration (hrs) | 8.1±0.1    | 7.9,8.3 | 8.2±0.009  | 8.0,8.4 | 8.2±0.1     | 8.0,8.5   |
| Mood State           | 3.5±0.5    | 2.3,4.5 | 3.4±0.6    | 2.3,4.4 | 3.7±0.6     | 2.5,4.8   |
| Sleep Quality        | 2.6±0.4    | 1.8,3.3 | 2.7±0.4    | 2.0,3.5 | 2.6±0.4     | 1.8,3.4   |
| Muscle Readiness***  | 0.9±0.4    | 0.2,1.7 | 1.8±0.4    | 1.1,2.5 | 2.1±0.4     | 1.3,2.9   |
| Diet Yesterday       | 5.2±0.7    | 3.9,6.5 | 5.2±0.6    | 3.9,6.4 | 4.6±0.7     | 3.3,5.9   |
| Academic Pressure**  | 5.0±0.4    | 4.2,5.8 | 1.6±0.4    | 0.9,2.3 | 0.7±0.4     | -0.08,1.5 |
| Health Indicators    | 3.8±0.6    | 2.6,5.0 | 3.9±0.6    | 2.8,5.2 | 3.7±0.6     | 2.4,4.9   |
| Energy Level         | 1.2±0.5    | .25,2.2 | 1.3±0.5    | 0.4,2.2 | 1.8±0.5     | 0.8,2.7   |

\*pre-season > in-season, pre-season > post-season

\*\*pre-season > in-season > post-season

\*\*\*pre-season < in-season, pre-season < post-season

## Conclusions

- Pre-season consisted of high training loads which lead to worse wellness scores
- As the season progressed, training volume decreased which led to improved wellness scores
- Academic Pressure should be considered when training collegiate athletes

## Practical Application

Knowing seasonal trends in training load will allow strength and conditioning coaches to appropriately tailor training volumes and intensities throughout the season and keep athletes performing at the highest level.

## Acknowledgments

The authors would like to acknowledge Kevin Schultz and the strength and conditioning staff at the University of Wisconsin-Madison for their contribution to this project

## References

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