

HORMONAL BIOMARKER RESPONSE TO UNDULATING PERIODIZATION AND THROWING VOLUME IN COLLEGIATE BASEBALL PITCHERS

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INTRODUCTION

- Baseball is a highly individualized sport where internal and external training load impacts players performance independently.
- Overall, injury mitigation in baseball pitchers is of the utmost importance in maintaining longevity and a high level of performance in sport.
- To date, crude pitch count is the only way to monitor training loads and their impact on pitching performance.
- To better understand individual adaptation to training volume in practice and in the weight room, throwing volume and training volume were measured over six-weeks during the pre-season period.
- Hormonal biomarkers also provide practitioners and coaches a better look at the internal load players are facing throughout different training periods.
- Testosterone is thought to promote muscle growth and increases in strength in response to resistance training¹, while prolonged increases in cortisol are thought to breakdown skeletal muscle.

METHODS

- 22 DIII baseball pitchers from the University of Mary Hardin-Baylor were recruited for this study.
- 20 of the 22 met all inclusion criteria.
- Data analysis is based on 8 participants who had **full compliance** throughout the entire study.
- Saliva samples were collected every Monday morning throughout spring training.
- Throwing volume varied by day for each athlete and was prescribed by the pitching coach.
- Participants had mandatory weights Monday, Tuesday, Thursday each week.
- Linear mixed effects models were fitted with fixed effects for time (6 categorical levels) and a random effect of athlete.
- All statistical analyses were performed using R via RStudio with alpha set at 0.05.

RESULTS

- N = 8; 20.5 ± 1.22 yrs; 183.59 ± 5.70 cm; 87.98 ± 9.12 kg
- Throwing volume (3389.53 ± 2237.38)
- Training load (482.57 ± 241.08)
- Significant effect across time on Testosterone (p <0.001)
- Significant increase from baseline to week 3 (p <0.05)
- Significant increase from baseline to week 4 (p <0.05)
- Significant increase from baseline to week 5 (p <0.05)
- Significant increase from baseline to week 6 (p <0.001)
- Significant increase from week 3 to week 6 (p <0.05)
- Significant increase from week 4 to week 6 (p <0.05)
- No significant effects on Cortisol were found

REFERENCES

(1) Vingren, J. L., Kraemer, W. J., Ratamess, N. A., Anderson, J. M., Volek, J. S., & Maresh, C. M. (2010). Testosterone physiology in resistance exercise and training: the up-stream regulatory elements. Sports medicine (Auckland, N.Z.), 40(12), 1037–1053. <https://doi.org/10.2165/11536910-000000000-00000>

UNDULATING WEIGHTLIFTING AND THROWING VOLUMES HAVE A POSITIVE IMPACT ON HORMONAL BIOMARKERS.

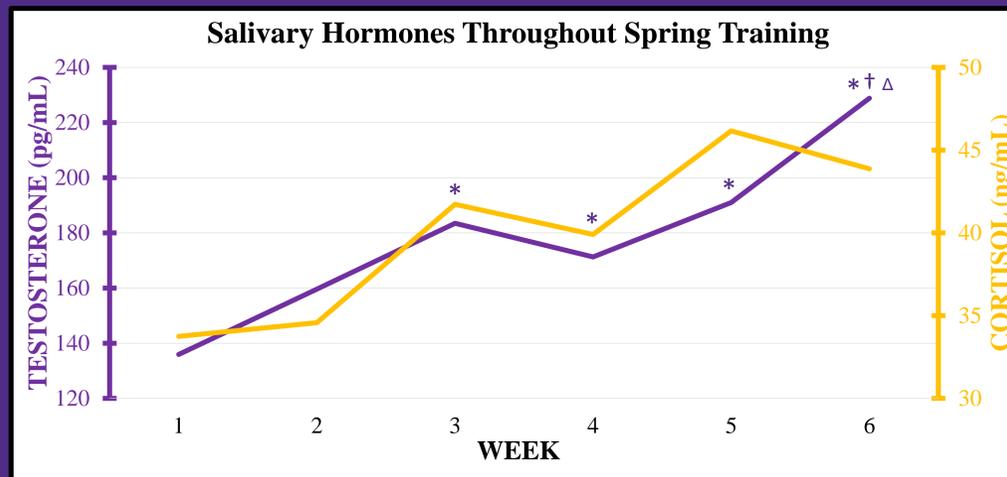


Figure 1: Average salivary hormone levels for all participants.

* - Testosterone concentration is statistically significant from baseline.

† - Testosterone concentration is statistically significant from week 3.

Δ - Testosterone concentration is statistically significant from week 4.

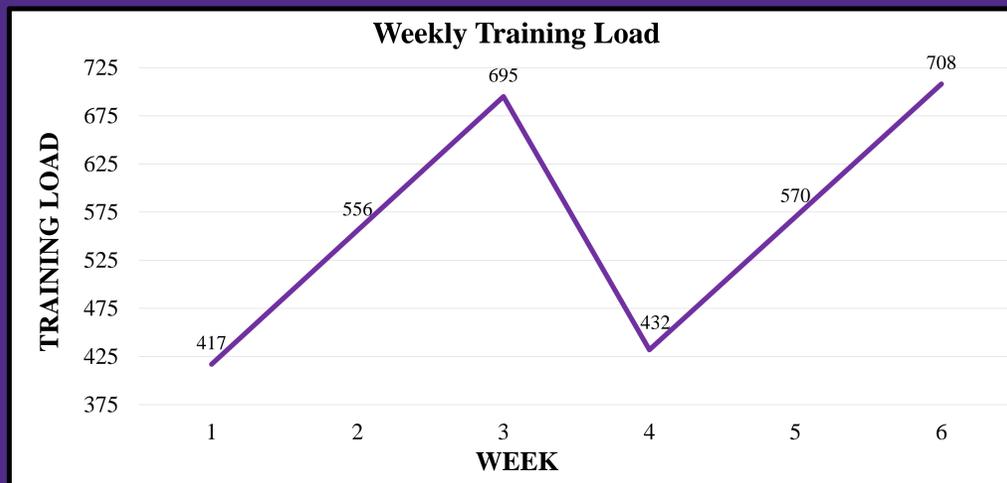


Figure 2: Weekly training load in weight room for all participants.

RESULTS

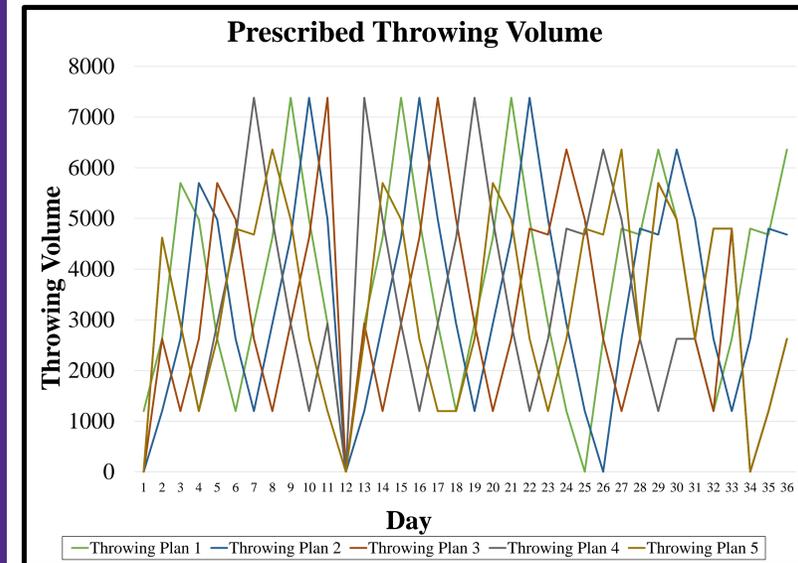


Figure 3: Daily prescribed throwing plans throughout spring training. Some participants were on the same plan throughout the six weeks.

CONCLUSIONS

- Significant increases in salivary testosterone concentrations were observed during a 6-week preseason training period in Division III collegiate baseball pitchers while increases in cortisol were non-significant.
- Tracking hormonal biomarkers may give coaches a more comprehensive understanding of the internal load response to external loads.
- Future research may include monitoring emotional state throughout testing period as well as greater sample size to understand the overall population more adequately.

PRACTICAL APPLICATION

- Prescribing individualized, undulating throwing and weightlifting programs for collegiate pitchers could increase the ability of athletes to positively adapt to training stimulus throughout the preseason.
- Further monitoring is warranted to further assess adaptation throughout the competitive season which may allow for improved player monitoring for program individualization, injury mitigation, and nonfunctional overreaching or over training as player workload increases.

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