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Optimizing Athletic Throwing Power For Increased Training Efficiency

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Motivation

- The demand for higher pitch velocity has increased at all levels of competitive play within baseball
- Weighted baseball training programs are a common way to increase pitch velocity
- The efficacy and safety of weighted ball throwing is not fully understood
- The aim of this study is to further investigate the mechanics of pitching under and overweight balls in order to better understand their role in athletic training

Materials & Methods

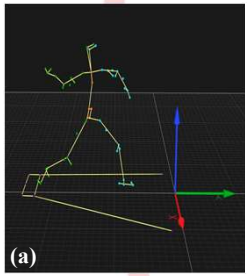


Figure I: A skeletal model mid-pitch, constructed in Qualisys Track Manager (a) A high speed Oqus motion capture camera from Qualisys (b)

- 10 experienced pitching participants were recruited to pitch a 10 ball (3-12 oz.) weighted set in the Athletic Performance Laboratory
- Pitching performance was recorded using Qualisys motion capture cameras and Qualisys Track Manager software
- Pitch velocity was tracked using a Stalker Sport radar gun
- Motion capture data was further analyzed in Visual 3D software for biomechanics
- Data collected in the Athletic Performance Lab

Results & Discussion

II: Velocity and Momentum Characterization

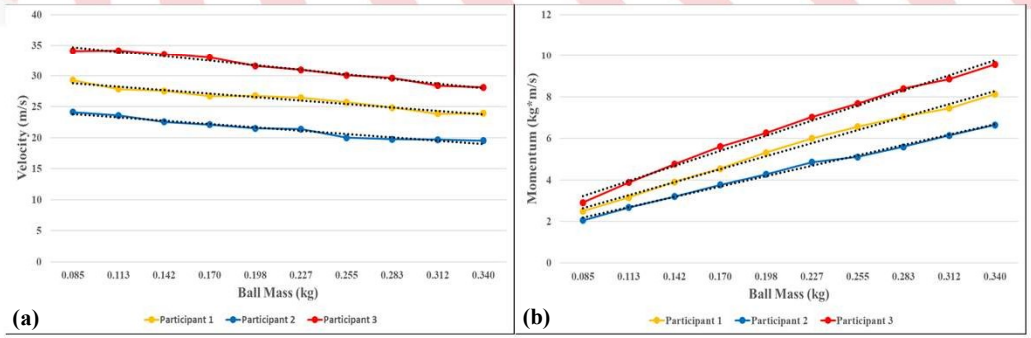
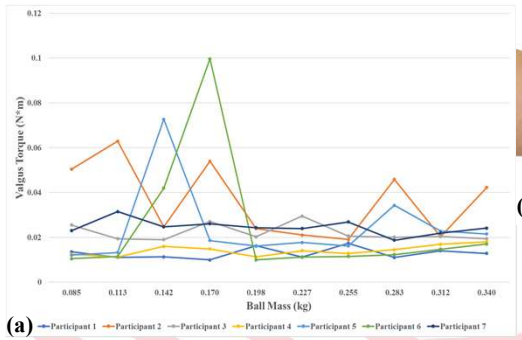


Figure II: The velocity (a) and imparted momentum (b) for 3 participants at each ball mass. Pitch velocity linearly decreases while momentum linearly increases for increasing ball mass. ($R^2 \geq 0.95$ for all). Other participants closely resemble the displayed trends with accurate linear regressions.

III: Elbow Valgus Torque



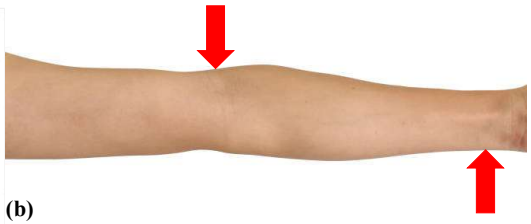


Figure III: Maximum elbow valgus torque experienced for each participant at each weighted ball (a) Elbow valgus torque (b)

IV: Discussion

- Both velocity and momentum show a strong linear correlation with ball mass - velocity decreasing and momentum increasing – for all participants
- Elbow valgus torque does not show any trends related to ball mass
- Values for elbow valgus torque are surprisingly low (previously reported values of 70 – 90 $N \cdot m^1$)
- High likelihood of error within torque calculations as evidenced by low values
- Elbow angles remain nearly constant at varying weights
- Shoulder torque/angles were not investigated in conjunction with elbow angles

Conclusion & Outlook

Utilizing the Qualisys Motion Capture technology available within the University of Nebraska Lincoln's Athletic Performance Laboratory, we were able to record the pitching mechanics of 10 experienced pitchers. Due to early shutdown of UNL facilities, only 7 of the participants were able to be fully processed within Visual 3D.

Investigation of pitch velocity and momentum revealed a positive linear correlation between momentum and ball mass and a negative correlation between velocity and ball mass. Further investigation could involve characterizing pitching power and individual profile based on linear slope fit.

Elbow valgus torque is responsible for much of the load that is experienced by the elbow during a pitching motion. Investigation and analysis of maximum elbow valgus torque experienced during each weighted pitch did not reveal any obvious trend. Research into this aspect of the study is ongoing, however one possible theory is that in order to protect themselves at higher weights, participants instinctively utilized safer biomechanics.

Overall, results for the effect of weighted baseball training are inconclusive, however, this study would benefit greatly from a larger sample size.

References

1. Fleisig GS, et al (2017) Biomechanical Analysis of Weighted-Ball Exercises for Baseball Pitchers. *Sports Health.* 9(3): 210-215