

## **BAB V**

### **KESIMPULAN DAN REKOMENDASI**

#### **A. Kesimpulan**

Penelitian ini menganalisa kinematik dari *pitcher* baseball ketika melempar bola dalam kondisi kelelahan, di analisis pada saat gerakan *phase lead foot contact phase, arm cooking phase, arm acceleration phase dan ball release phase*. Penelitian ini merupakan salah satu kajian yang mendukung efektifitas dari teknik yang dilakukan saat *pitcher* melempar baik sebagai evaluasi teknik bagi pelatih dan atlet ataupun sebagai tolak ukur kemampuan dari teknik yang atlet lakukan. Penelitian ini menyimpulkan bahwa Dari hasil uji Korelasi diketahui 19 indikator yang diteliti, hanya dua indikator yang memiliki hubungan signifikan terhadap kecepatan bola yaitu *knee flexion* dan sudut *Lateral Trunk Tilt*.

#### **B. Rekomendasi**

Sehubungan dengan penelitian yang telah dilakukan, maka penulis mengemukakan beberapa rekomendasi sebagai berikut :

- Bagi para akademisi untuk melakukan penelitian lebih mendalam akan segmensegmen biomekanika lain yang berkontribusi terhadap performa baseball *pitcher*
- Bagi para atlet untuk menjadi pengetahuan dan wawasan akan teknik yang lebih efisien dalam menghasilkan performa yang lebih baik umumnya.
- Bagi para pelatih untuk menjadi pengetahuan dan sarana informasi dalam meningkatkan teknik yang efektif bagi atlet. Pelatih juga perlu melakukan tes biomekanika yang berkerjasama dengan para akademisi dalam meningkatkan kemampuan atlet untuk pencapaian prestasi.
- Atlet diharapkan mampu berlatih VO2 Max sehingga performa pitching *pitcher* baseball dapat lebih efisien.
- Perlu dilakukannya penelitian lebih lanjut mengenai aktifitas otot dominan menggunakan *electromiography*

Hasil penelitian ini semoga dapat dikembangkan , dan dapat dijadikan sebagai bahan informasi maupun referensi bagi pihak yang berkepentingan dibidang tersebut dalam upaya pembinaan dan peningkatan kualitas baseball Indonesia, dan sumbangan pemikiran serta bahan kajian bagi peneliti lain untuk mengadakan penelitian lebih lanjut.

## Daftar Pustaka

- Anz, A. W., Bushnell, B. D., & Griffin., et al. (2010). The American Journal of Sports Medicine. <https://doi.org/10.1177/0363546510363402>
- Arthur, M., & Sullivan, T. J. (n.d.). Biomechanics of baseball pitching preliminary report, 216–222.
- Bakshi, N. K., Inclan, P. M., & Kirsch., et al. (2019). Current Workload Recommendations in Baseball Pitchers A Systematic Review, 1–13. <https://doi.org/10.1177/0363546519831010>
- Calabrese, Gary J., et al. (n.d.). INVITED CLINICAL COMMENTARY PITCHING MECHANICS , REVISITED, 8(5), 652–660.
- Caldwell, J. E., & Alexander., et al. (n.d.). Weighted-Ball Velocity Enhancement Programs for Baseball Pitchers A Systematic Review, 1–9. <https://doi.org/10.1177/2325967118825469>
- Dun, S., Ā, G. S. F., & Loftice., et al. (2007). The relationship between age and baseball pitching kinematics in professional baseball pitchers, 40, 265–270. <https://doi.org/10.1016/j.jbiomech.2006.01.008>
- Escamilla, R. F., Barrentine, S. W., & Fleisig., et al. (2006). Pitching Biomechanics as a Pitcher Approaches Muscular Fatigue During a Simulated Baseball Game, 23–33. <https://doi.org/10.1177/0363546506293025>
- Fazarale, J. J., & Magnussen., et al. (2012). Knowledge of and Compliance With Pitch Count Recommendations: A Survey of Youth Baseball Coaches, 43221, 202–204. <https://doi.org/10.1177/1941738111435632>
- Fehringer, E. V, & Dilisio., et al. (n.d.). Changing Body Movement Patterns in 9-Year-Old Baseball Pitchers A Pilot Study, 1–7. <https://doi.org/10.1177/2325967117713023>
- Ford, & Shin., et al. (1995). PITCHING IN ACCELERATION PHASE ', (1993), 43–48.
- Fortenbaugh, D., & Fleisig, Glenn S., et al. (2009). Baseball pitching biomechanics in relation to injury risk and performance. *Sports Health*, 1(4), 314–320. <https://doi.org/10.1177/1941738109338546>
- Fry, K. E., Pipkin, A., & Wittman., et al. (2016). Youth Baseball Pitching Stride Length :, 9(3), 205–209. <https://doi.org/10.1177/1941738116679815>
- Grantham, W. J., & Byram., et al. (n.d.). The Impact of Fatigue on the Kinematics of Collegiate Baseball Pitchers, 1–10. <https://doi.org/10.1177/2325967114537032>
- Jílek, Josef., et al. (2004). Peníze a měnová politika, 744. <https://doi.org/10.1123/jab.23.1.42>

- Kinoshita, H., & Obata, Satoshi., et al. (2017). Finger forces in fastball baseball pitching. *Human Movement Science*, 54(April), 172–181. <https://doi.org/10.1016/j.humov.2017.04.007>
- Knudson, D., et al. (2004). *The Hill Muscle Model. Fundamentals of Biomechanics*. [https://doi.org/10.1016/S0031-9406\(05\)61176-5](https://doi.org/10.1016/S0031-9406(05)61176-5)
- Laudner, K. G., Wong, R., & Meister., et al. (2018). The influence of lumbopelvic control on shoulder and elbow kinetics in elite baseball pitchers. *Journal of Shoulder and Elbow Surgery*. <https://doi.org/10.1016/j.jse.2018.07.015>
- Laughlin, W. A., Fleisig, G. S., & Scillia., et al. (2014). The American Journal of Sports Medicine Deficiencies in Pitching Biomechanics in Baseball Players With a History of. <https://doi.org/10.1177/0363546514552183>
- Luera, M. J., Dowling, B., & Magrini., et al. (2018). Role of Rotational Kinematics in Minimizing Elbow Varus Torques for Professional Versus High School Pitchers, 1–8. <https://doi.org/10.1177/2325967118760780>
- Matta, P. A., & Myers, Joseph B., et al. (2015). Factors Influencing Ball-Player Impact Probability in Youth Baseball, 8700. <https://doi.org/10.1177/1941738113498209>
- Melugin, H. P., & Larson., et al. (2019). Baseball Pitchers ' Perceived Effort Does Not Match Actual Measured Effort During a Structured Long-Toss Throwing Program, 1–6. <https://doi.org/10.1177/0363546519850560>
- Mullaney, M. J., & Mchugh., et al. (n.d.). Upper and Lower Extremity Muscle Fatigue After a Baseball Pitching Performance, 108–113. <https://doi.org/10.1177/0363546504266071>
- Murray, T. A., & Cook., et al. (2001). The Effects of Extended Play on Professional Baseball Pitchers, 29(2), 137–142.
- Nissen, C. W., & Westwell, Melany., et al. (2009). The American Journal of Sports Medicine A Biomechanical Comparison of the Fastball and Curveball in Adolescent. <https://doi.org/10.1177/0363546509333264>
- Oi, T., & Yoshiya., et al. (2019). Biomechanical Differences Between Japanese and American Professional Baseball Pitchers, 1–8. <https://doi.org/10.1177/2325967119825625>
- Okoroha, K. R., & Meldau., et al. (n.d.). Effect of Fatigue on Medial Elbow Torque in Baseball Pitchers A Simulated Game Analysis, 1–5. <https://doi.org/10.1177/0363546518782451>
- Oliver, G. D., & Plummer, H. A. et al. (2015). Effects of Pitching a Simulated Game on Upper Extremity Kinematics in Youth Baseball Pitchers ClinMed, 3–6.
- Oyama, S., & Yu., et al. (2013). The American Journal of Sports Medicine Effect of Excessive Contralateral Trunk Tilt on Pitching Biomechanics and Performance. <https://doi.org/10.1177/0363546513496547>

- Oyama, S., & Yu., et al. (2014). *The American Journal of Sports Medicine*.  
<https://doi.org/10.1177/0363546514536871>
- Pereira, A. F., Silva, M. T., & Martins, J M., et al. (2011). Implementation of an efficient muscle fatigue model in the framework of multibody systems dynamics for analysis of human movements, 225, 359–370.  
<https://doi.org/10.1177/1464419311415954>
- Portney, D. A., & Buchler., et al. (2017). Influence of Pitching Release Location on Ulnar Collateral Ligament Reconstruction Risk Among Major League Baseball Pitchers, 1–8. <https://doi.org/10.1177/2325967119826540>
- Republic, Czech., et al. (2007). The effect of muscle fatigue on the behavior of single muscle fibre, *I*, 401–410.
- Rusdiana, Ray, H. R. D., & Umaran., et al. (2017). My IOPscience Fatigue Impact to Mechanical Movement of Maximal Instep Kicking in Soccer This content has been downloaded from IOPscience . Please scroll down to see the full text ., (March).
- Saltzman, B. M., Mayo, B. C., & A., et al. (2018). How many innings can we throw : does workload influence injury risk in Major League Baseball ? An analysis of professional starting pitchers between 2010 and 2015. *Journal of Shoulder and Elbow Surgery*. <https://doi.org/10.1016/j.jse.2018.04.007>
- Seroyer, S. T., & Nho, et al. (2010). The Kinetic Chain in Overhand Pitching : Enhancement and Injury Prevention, 2(2), 135–146.  
<https://doi.org/10.1177/1941738110362656>
- Solomito, M. J., & Garibay., et al. (n.d.). Sagittal Plane Trunk Tilt Is Associated With Upper Extremity Joint Moments and Ball Velocity in Collegiate Baseball Pitchers, 19–21. <https://doi.org/10.1177/2325967118800240>
- Solomito, M. J., & Garibay., et al. (2015). The American Journal of Sports Medicine P < P Lateral Trunk Lean in Pitchers Affects Both Ball Velocity and. <https://doi.org/10.1177/0363546515574060>
- Stodden, D. F., & Fleisig., et al. (2005). Relationship of Biomechanical Factors to Baseball Pitching Velocity : Within Pitcher Variation, 44–56.
- Tate, J. P., & Solomito, et al. (n.d.). A Biomechanical Evaluation of the Kinetics for Multiple Pitching Techniques in College-Aged Pitchers, 1–8.  
<https://doi.org/10.1177/2325967113508255>
- Trigt, B. Van, Schallig, W., & Graaff, E. Van Der. (2018). Knee Angle and Stride Length in Association with Ball Speed in Youth Baseball Pitchers, 1–10.  
<https://doi.org/10.3390/sports6020051>
- Urbin, M. A., & Fleisig, Glenn S., et al. (2013). *The American Journal of Sports Medicine* P < P. <https://doi.org/10.1177/0363546512467952>
- Werner, S. L., Suri, M., Jr, A. G., Meister, K., & Jones, D. G. (n.d.). Relationships

between ball velocity and throwing mechanics in collegiate baseball pitchers. *Journal of Shoulder and Elbow Surgery*, 905–908. <https://doi.org/10.1016/j.jse.2008.04.002>

Wilk, K. E., & Macrina., et al. (2011). The American Journal of Sports Medicine Correlation of Glenohumeral Internal Rotation Deficit and Total Rotational Motion. <https://doi.org/10.1177/0363546510384223>

Winter, David A., et al. (2009). *BIOMECHANICS AND MOTOR CONTROL OF Fourth Edition*.

Yu, J., & Bairner, Alan., et al. (2011). Confucianism , baseball and ethnic stereotyping in Taiwan, (16). <https://doi.org/10.1177/1012690211424483>

Zheng, N., & Fleisig., et al. (2004). *Biomechanics of Pitching Chapter 9 Biomechanics of Pitching*. <https://doi.org/10.1007/978-1-4419-8887-4>

Zwambag, D. P., & Brown, et al. (2009). The Effect of Contralateral Submaximal Contraction on the Development of Biceps Brachii Muscle Fatigue. <https://doi.org/10.1177/0018720814550034>