

## RELATIONSHIP BETWEEN PHYSICAL DEVELOPMENT AND PERFORMANCE IN YOUTH BASEBALL PITCHERS

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In 2013, two Dutch universities and the Dutch baseball association started project “Fastball” which is aimed at improving training and coaching of youth and elite players such that more of our pitching talents would reach 90mph fast pitch throwing limit and to reduce the injury rate for both talents and elite players.

In the period March 2014 – October 2016, we monitored 125 youth pitchers between ages 12 – 18 years in a dynamic cohort study. Recordings took place twice per year and consisted of questionnaires on musculoskeletal health, anthropometrics, strength, range of motion and throwing technique and performance (i.e. ball velocity) when pitching. Not surprisingly, throwing speed increased with age (max ball velocity =  $-121.6 + 70.6 * \ln(\text{Age})$ ), while external rotation range of motion of the dominant shoulder did not significantly change over the years.

Over the entire study, 46% of the players reported shoulder symptoms and 42% reported elbow symptoms.

In this presentation, associations between anthropometrical, functional and strength factors with throwing speed will be further discussed, with special attention for factors that negatively influence development, the so-called “development killers”.

## EVIDENCE BASED PHYSICAL TRAINING TO PREVENT NONCONTACT ANTERIOR CRUCIATE LIGAMENT INJURIES AND IMPROVE PERFORMANCES FOR BALL SPORTS ATHLETES

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Anterior cruciate ligament (ACL) injuries are common and serious injuries, especially for ball sport athletes who frequently implement sharp decelerating-accelerating motions. Studies showed that most of ACL injuries occur in noncontact fashion, especially during sudden deceleration motions including landing and change of direction motions. Thus, in order to improve performance and prevent noncontact ACL injuries, physical training programs for ball sport athletes should aim to improve abilities not only to quickly accelerate but also safely decelerate their body center of mass.

Because ground reaction force (GRF) is the largest external force that athletes receive during sharp decelerating motions and because GRF is considered to be a critical force to cause ACL injuries, one of the important aspects to prevent ACL injuries is to manage the amount and direction of GRF relative to the body segments. Therefore, this presentation will introduce the scientific background and common physical training goals for how to receive GRF not only safely but also effectively to perform sharp decelerating-accelerating motions. In addition, some exercise examples to achieve these training goals will be introduced.