



## The Associations between Glenohumeral Range of Motion (ROM) during Off-Season and On-Season and the Ball Speed among Collegiate Baseball Pitchers

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### Dear Editor-in-Chief

There are some studies being conducted to prevent injury of the glenohumeral joint. Some studies analyze the range of motion of the glenohumeral joint before, during and after the season on the Collegiate baseball players and the association with ball speed, resting and also development of effective training programs to increase flexibility and correct postures during pitching (1). For collegiate players at the age of 20 who had started from elementary levels at the age of ten, having a pitching career of ten years, the Internal Rotation (IR) will have been decreased, as the External Rotation (ER) would have increased as they have matured. This will result an imbalance in the structure and fascia in the rotational and static structure in the related muscle (2).

The repeated overhead throwing motion increases the external rotation of the Glenohumeral rotation. As the total rotation maintains about 180 degrees, IR results in a decrease of motion (3). For the youth athlete pitcher the IR decreased gradually as the athlete aged, and as the athlete had continued competitive pitching during his or her collegiate career the IR decrease is found to be relatively higher (4). Therefore, for the collegiate athlete in their 20s, compared to fielders,

the pitchers ER ROM in their primary shoulder will increase whereas their IR ROM will decrease. As a result, the Glenohumeral IR ROM decrease can be a cause for internal impingement syndrome (5).

With sufficient Glenohumeral ROM gained the pitcher will be able to convert a smooth and effective motion from the initial arm cocking through the follow through motion. When the ROM is limited, it would result in a higher probability of decreased performance and even increase the risk of a major injury (6). The maximum velocity of a pitch is the result of the interactions of the associated body and muscle components achieved by efficient use of the form and effective timing. The IR angular velocity differential had no significant correlation with the velocity itself (7). Therefore it can be stated that compared to players in other positions, for the pitcher to increase the velocity of a fastball pitch, rehabilitation with the emphasis of increasing the flexibility of IR to maintain the overall stability of Glenohumeral joints is required.

For the research the ROM was measured using a Goniometer. The athlete was positioned laying down with the axis centered in the center point



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of the shoulder joint. The study was conducted in Chung-Ang University Exercise Prescription Office, in 2020. The fulcrum was positioned in line with the upper limb at 90-degree position. With the axis centered to the shoulder joint center the IR and ER range of motion was measured. For the measurement of the pitch velocity, a Radar Gun (Sport Radar, 34.7GHZ, SP78585 Applied Concepts INC, USA 2018) was used to measure the top speed (over the plate speed) for 30 pitches.

Interpretation and analysis of the statistical data was done with SPSS 26 (IBM Corp., Armonk, NY, USA). Measurements of the variables were processed for average and standard deviation. The ball speed before season and after season,

the shoulder ROM (IR, ER) was analyzed though *t*-test. Significant level was set at 0.05 ( $P < 0.05$ ).

This research was conducted under the monitor and approval of the Chung-Ang University Bioethics Institution Review Committee (Project 1041078-202004-HR-108-01).

The research showed that the velocity had statistical significance for the collegiate pitcher ball speed ( $P < 0.01$ ), IR ( $P < 0.001$ ), ER ( $P < 0.01$ ) seen in Table 1. For the collegiate pitcher the velocity of the pitch decreased in line with the IR decrease. Therefor the pitcher would require to implement a systematic training program to maintain the flexibility of the Glenohumeral joint during the season.

**Table 1:** A changes in speed ball, ROM of youth baseball pitchers

<i>Variable</i>	<i>Pre-season</i>	<i>Stove league</i>	<i>t</i>	<i>df</i>	<i>P</i>
speed ball	143.20±2.107	140.67±1.470	3.324	30	0.01**
IR	34.96±.718	31.50±1.676	4.568	30	0.001***
ER	106.50±1.408	109.83±5.265	3.854	30	0.01**

Values are mean ± SD, \*\* $P < 0.01$ , \*\*\* $P < 0.001$

The pitching motion requires higher amounts of extension of the muscles and tendons, which to prevent overload of the muscle will stiffen or harden given that exceeds a certain level. This will lead to decreased flexibility and can incur fatigue and injury. Therefor even if the athlete has an efficient form of pitching motion, programs should be in place to maintain flexibility. Decreased flexibility can be a cause for collegiate pitchers injuries building from the stain of the tendons. As for the training itself, it can be advised that for the pitcher which require power and speed Hypertrophy may not be appropriate. The study advises that the athlete maintain a steady program of Glenohumeral joint flexibility exercise along with training of the smaller muscles surrounding the shoulder.

### Conflict of interests

The authors declare that there is no conflicts of interest.

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