Norm-referenced criteria for strength of elbow for the Korean high school baseball players using computer assisted isokinetic equipment *

Su Hyun Kim*
Sunsoochon Hospital
Seoul, Korea
trainerksh86@gmail.com

Abstract—The purpose of this study was to norm-referenced criteria for isokinetic strength of the elbow joints for the Korean high school baseball players. Two hundred one high school baseball players were participated in this study. They didn't have any medical problem at the elbow joins. The test was conducted four times in the elbow flexion/extension test at 60°/sec speed. HUMAC NORM (CSMI, USA) system was used to obtained the value of peak torque, peak torque % body weight. The results were presented as a norm-referenced criterion value using 5-point scale of cajori, by 5 group (6.06%, 24.17%, 38.30%, 24.17%, and 6.06%). On the basis of the results analyzed in this study, the conclusion were drawn as follow. The provided criterion of peak torque and peak torque % body weight are very useful information for high school baseball player, baseball coach, athletic trainer and sports injury rehabilitation specialists in injury recovery and return to rehabilitation, to utilize as an objective clinical assessment data.

Keywords—baseball; elbow joints; isokinetic equipment; norm-referenced criteria

I. INTRODUCTION

Isokinetic exercises can be conducted while receiving the same maximum weight and therefore is more effective in improving muscle strength and has a high reliability for mechanical exercise assessment of the muscle function. Therefore, muscle contraction at a constant speed appears as torque that triggers acceleration and which is the strength that allows the fast movement of the body part. The assessment for the exercise results of isokinetic muscle strength is done for peak torque, peak torque % body weight and therefore is very effective[1,2,3,4,5]. The objective measurement of the reference muscle strength plays the role of standard data that is valuable of assessing abnormal muscle strength and identifying a decrease in bodily function[6]. As such, objective studies on various muscle groups have been conducted. But there are not sufficient preceding studies on the elbow. Therefore this study seeks to set this reference point and provide a stand indicator for, rehabilitation specialists, baseball coach and high school baseball players that experience frequent injury.

II. METHODS

Randomly selected 201 male baseball players of 10 high schools located in the Seoul, Gyeonggi area and registered with the Korea Baseball Association. The purpose of the study was thoroughly explained to the participants and consent was received that they will do their best. The physical characteristics of the subjects are as shown in Table. 1.

TABLE 1. CHARACTERISTICS OF SUBJECTS

<table>
<thead>
<tr>
<th>N</th>
<th>Height(cm)</th>
<th>Weight(kg)</th>
<th>Age(yrs.)</th>
<th>Career(yrs.)</th>
<th>%Body Fat(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>201</td>
<td>176.20±5.61</td>
<td>76.58±10.98</td>
<td>17.66±0.70</td>
<td>6.68±1.57</td>
<td>15.92±5.6</td>
</tr>
</tbody>
</table>

Values are presented as mean±standrad deviation

HUMAC NORM (Stoughton, MA, USA), equipment for measuring isokinetic muscle strength was used to measure the muscles of the elbow. The test was conducted 4 times at 60 deg/sec. For accurate measurement, a practice of 3 times was done at maximum muscle strength before the test, a rest was taken, and then the test was conducted(Fig. 1).

Fig. 1. Measurement of the computer assisted isokinetic muscle strength in the elbow joint.

Peak torque: The muscle strength measured without consideration given to body weight. The torque of the extensor and flexor after 3 repeats was measured at 60 deg/sec. The unit is Nm[7].

*Corresponding author: Su Hyun Kim
Peak torque % body weight: The muscle strength measured with consideration given to body weight. The maximum torque of the extensor and flexor after 3 repeats is divided by the body weight. This figure represents relative muscle strength and the unit used is % [7].

III. RESULTS

The analysis of measured variables using the HUMAC NORM (Stoughton, MA, USA) is as follows. The mean and standard deviation of the measured values for peak torque and peak torque % body weight in the extensor and flexor of the elbow joint at angular velocities of 60 deg/sec are as shown in Table 3.

TABLE 2. THE VALUES OF PEAK TORQUE & PEAK TORQUE % BODY WEIGHT ELBOW JOINT FLEXOR AND EXTENSOR AT 60°/sec SPEED

<table>
<thead>
<tr>
<th>Speed</th>
<th>Muscle GRP</th>
<th>Side</th>
<th>Peak Torque(Nm)</th>
<th>Peak Torque % Body Weight(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60°/sec</td>
<td>Fle</td>
<td>Dominate</td>
<td>97.12±23.08</td>
<td>127.08±26.44</td>
</tr>
<tr>
<td></td>
<td>Ext</td>
<td>Dominate</td>
<td>97.12±23.08</td>
<td>127.08±26.44</td>
</tr>
</tbody>
</table>

Values are presented as mean±standard deviation
Fle: flexor, Ext: extensor
GRP: group

TABLE 3. NORM-REFERENCED CRITERION VALUES OF PEAK TORQUE & PEAK TORQUE % BODY WEIGHT ELBOW JOINT FLEXOR AND EXTENSOR AT 60°/sec SPEED

<table>
<thead>
<tr>
<th>Stage</th>
<th>Fle Dominate</th>
<th>Very Low</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td>60°/sec (PT)</td>
<td>25.7 less</td>
<td>25.8-33.7</td>
<td>33.8-41.9</td>
<td>42-50</td>
<td>50.1 more</td>
<td></td>
</tr>
<tr>
<td>Ext Dominate</td>
<td>26.9 less</td>
<td>27-38.7</td>
<td>38.8-50.5</td>
<td>50.6-62.2</td>
<td>62.3 more</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage</th>
<th>Fle Dominate</th>
<th>Very Low</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td>60°/sec (PT%BW)</td>
<td>37.1 less</td>
<td>37.2-45.7</td>
<td>45.8-54.3</td>
<td>54.4-63</td>
<td>63.1 more</td>
<td></td>
</tr>
<tr>
<td>Ext Dominate</td>
<td>39 less</td>
<td>39.1-51.8</td>
<td>51.9-64.6</td>
<td>64.7-77.5</td>
<td>77.6 more</td>
<td></td>
</tr>
</tbody>
</table>

PT: peak torque(Nm), PT%BW: peak torque % body weight(%)
Fle: flexor, Ext: extensor
IV. CONCLUSION

This paper proposes an accurate elbow joint muscle strength criterion of high school baseball players. The purpose of this study was to evaluate the training plan, training results leader for baseball players and trainers and to provide evidence that could be a reference. By evaluating quantitatively determined objectively elbow muscle strength evaluation of high school baseball players presented a reference value player is considered do a great deal to help to return during injury recovery and rehabilitation of basic data. In conclusion, the absolute evaluation criterion of strength and relative strength of the elbow joint, using the computer assisted isokinetic strength measurement equipment targeting high school baseball players 201 people are considered very useful such players, baseball coaches, athletic trainer and rehabilitation specialist, objective to be utilized as clinical assessments.

References