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## Effect of resistance band and weight training on throwing velocity of club level baseball players in Sri Lanka

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### ABSTRACT

Throwing velocity is undoubtedly considered as one of the crucial factors that affects output of a baseball game. To improve throwing velocity, numerous training methods and approaches are being used. Therefore, the purpose of this study was to find the effect of the resistance band and weight training on throwing velocity of age  $27 \pm 3$  (mean  $\pm$  SD) (club level baseball players in Sri Lanka). Forty baseball players were recruited for the 8-week training program based on the inclusion criteria and availability of players. Initially, athletes were assigned into 3 groups: a control group ( $n=10$ ), a weight training group ( $n=15$ ), and a resistance band training group ( $n=15$ ). (The weight training group performed 6 upper body exercises by using barbells and dumbbells while the resistance band training group engaged in 6 upper body exercises with blue and red coloured bands. Moreover, the control group was only allowed to perform their daily routine baseball practices which were 3 days per week and 3 hours per day. Throwing velocity was measured by using a radar gun, and upper body strength was measured using the one-repetition maximum (1RM) (bench press test to determine the relationship between strength and throwing velocity). Both test results were evaluated by using pre-test and post-tests' descriptive and inferential statistics. The weight training group and the resistance band group showed significant differences in 1RM bench press and the radar gun tests while the control group showed only a significant difference in the strength test. In addition, the control group revealed no significant difference in throwing velocity. Furthermore, the weight training group showed the greatest improvement in throwing velocity and 1RM bench press tests, and then the resistance band group followed the same. In conclusion, Strength training and resistance band training can be utilized to develop strength in the upper body and it may help to develop throwing velocity in other throwing sports, such as cricket, throw ball and so on.

**KEYWORDS:** Throwing Velocity, Weight Training, Resistance-Band Training, Radar Gun Test, 1RM Bench Press Test

## **1 INTRODUCTION**

In the modern era, baseball has become one of the popular sports in the world, especially in the USA, Japan, Taipei, and Korea (Yoon et al., 2018). In any type of sport, fundamental skills should be gradually developed and mastered by players to sense the game. The most important fundamental skills in baseball are considered throwing, catching, fielding, and hitting (Johnson et al., 2001). Also, baseball performances depend on various bio-motor abilities. According to an investigation by Wooden et al., (1992), speed, strength, and power are the most associated bio-motor abilities that effect successful baseball performance. Among them, strength plays an important role in baseball whereas higher and effective force generation at the musculoskeletal system provides a greater advantage for players to execute movements faster with higher throwing velocity (Neumann, 2013).

Among the aforementioned fundamental skills, throwing velocity is undoubtedly considered as one of the major skills that determines the success or failure of the baseball performance. Coaches, as well as sports professionals expect to enhance throwing velocity of players by conducting both skill training and resistance training simultaneously using different forms of methods and approaches around the world. In baseball throwing, the pitching mechanism is a highly stressful activity that requires a greater force to drive the ball towards a particular target with higher velocity. Perhaps, baseball pitching is known to have the most stressful and ferocious arm movement among throwing

sports. Greater pitching velocity results in less time for hitters to decide to swing. Throwing velocity is also an important baseball performance variable for position players since the greater throwing velocity decreases time for a runner to advance to a base.

The ultimate goal of coaches in any sport is to gain the optimum performance of the players while reducing the risk of injuries to them. Therefore, to optimize peak performance, a wide variety of training methods: plyometric, functional, resistance, and callisthenic (Stone et al., 2000) are being applied at the various stages of an athlete's macrocycle. A review of the literature indicates that throwing velocity can be improved through resistance training while several studies have reported that 8 weeks resistance programs improve the throwing velocity of athletes (Newton and McEvoy, 1994, DeRenne et al., 2001). In baseball, weight training and resistance band training are the most common resistance training methods used to improve throwing velocity (Escamilla et al., 2010, Carter et al., 2007). Resistance can be created through a player's body weight, gravity, bands, weighted bars, or dumbbells (McMaster et al., 2009, Treiber et al., 1998, Kotarsky et al., 2018, Faigenbaum et al., 2009). Some exercise machines also can be used for resistance training, but they have a limited range of motion.

In Major league baseball (MLB), baseball pitchers can release the baseball at speeds approaching and sometimes exceeding 160 kph (approximately 45 m/s) . But in Sri Lanka, it has been speculated that the fastest pitch ever recorded in Sri Lankan

history was around 136 kph which did not have valid records. In order to compete with the international level, Sri Lankan baseball players should be able to reach higher throwing velocity and focusing on possible approaches to develop throwing velocity is crucial. Also, due to the improper and unsuitable training methods used in Sri Lanka, the majority of pitchers are experiencing minor or major acute and chronic injuries. Since strength plays an important role in injury prevention (Niederbracht et al., 2008), training methods like weight retraining and resistance band training have to be generalized in to the Sri Lanka Baseball club players. Moreover, no studies have been conducted in Sri Lanka on developing throwing velocity among baseball players. Therefore, the main objective of this study was to identify the effectiveness of resistance band and weight training programs on throwing velocity and upper body strength of age 25-30 club-level baseball players in Sri Lanka. Apart from that, it intended to discover the influence of strength on throwing velocity.

## **2 RESEARCH METHODOLOGY**

The target population was the club level baseball players in Sri Lanka. According to the statistics of the baseball federation of Sri Lanka, 453 players had registered at the end of the year 2017. A primary survey was conducted by including 3 criteria to select suitable players for the study. Those were: (a) healthy participants not having current injuries and with clear medical history in the last 6 months; (b) to be able to attend at least 85% of the training programs; (c) to be able to throw at

maximum velocity without pain when pre and post-tests are conducted.

All 453 registered players were subjected to the above three inclusion criteria, and 127 players were shortlisted. However, due to occupational problems and personal reasons, 27 and 14 players had given their consent not to participate in the program respectively. For this study, by considering the available resources, it was decided to select 40 players as the sample and further identified 10 players who had rarely or never engaged in both types of weight training and resistance band training. As a result, those 10 players were allocated for the control group and the rest of the 30 players who were familiar with strength training were divided into 2 groups randomly. Also, a written informed consent form was handed over to individuals by disclosing possible outcomes of the study and the confidentiality of data.

Control group pre-test and post-test experimental research design was adopted for this study. The dependent variable in this study was the throwing velocity of the baseball players, whereas the independent variables were the 8-week training programs: weight training, resistance band, and baseball training.

### **2.1 Testing Procedure**

#### **Radar Gun**

Before commencing the test, athletes were instructed to conduct their usual warm-up, stretching, and warm-up throws. Then they were given 3 throws from the pitcher plate to the catcher with 30-45 second rest

between each throw, and the measuring distance was 18.4 m. Throwing velocity was measured by the radar gun (Bushnell - 101911) which had been placed 2m behind the home plate and the average of three attempts was taken for analysis.

### **1RM Bench press**

This test was conducted one day prior to the radar gun test and warm-up, stretching was conducted by the participants with 5-10 reps of light to moderate weight. 1 minute after, 2 Havier warm-up sets of 2-5 reps were conducted with 2 minutes' rest between sets. After 3-4 minutes', athletes performed the one-rep maximum attempt with proper technique. After a successful attempt, load was increased by 5-10% while a failure attempt reduced the weight by 2.5-5%.

### **Table 1: Hypothesis Testing**

#### **2.2 Training procedure**

H1	H01	There is no significant impact of the baseball training program on throwing velocity
	Ha1	There is a significant impact of the baseball training program on throwing velocity
H2	H02	There is no significant impact of the weight training program on throwing velocity
	Ha2	There is a significant impact of the weight training program on throwing velocity
H3	H03	There is no significant impact of the resistance band training programs on throwing velocity
	Ha3	There is a significant impact of the resistance band training program on throwing velocity

All three groups: weight, resistance band, and control groups participated in their routine baseball practices 3 days per week and 3 hours per day. The weight training group conducted 6 upper body exercises; bench press, biceps curl, triceps curl, dumbbell lateral raise, dumbbell forward raise, and rowing. The intensity zones were 65% to 75% in the first 4 weeks along with 15 reps with 3 sets and then 75% to 90% in the following weeks with 8 reps which consisted of 4 sets. Similar exercises and intensities were conducted by the resistance band group using a blue and red resistance band. The control group did none of the weight training and resistance band training.

#### **2.3 Hypothesis**

Collected data were analyzed by using SPSS version 22 and several hypotheses were tested. Those are as follows.

### 3 RESULTS & DISCUSSION

Mean differences of both post-test and pre-test were analysed, and significance values

of all the data with both radar gun and 1 RM Bench press tests were higher than 0.05 (table 2), as data was normally distributed.

**Table 2: Normality test results**

Group	1RM Bench Press	Radar Gun
Control	.200	.200
Weight	.083	.081
Resistance	.159	.200

As the data was normally distributed One-way ANOVA test was used to determine if there were any significant differences in

the mean differences in the three groups. The results of both radar and 1RM bench press are shown in the following table.

**Table 3: P Values and Significance difference between mean differences**

Group	1RM Bench Press) mean difference(	Standard Deviation	Sig.	Radar Gun )mean difference(	Standard Deviation	Sig.
Control	1.70	1.337	.003	-.50	1.716	.381
Weight	7.13	2.031	.000	3.93	1.033	.000
Resistance	2.93	1.223	.000	1.60	2.098	.010

At the end of the training programs, it was depicted that the weight training group showed the highest strength improvement, reported +7.13 kg in the 1RM bench press test. Also, the throwing velocity of the weight training group recorded +3.93 kph development as the highest throwing velocity improvement among the groups. Furthermore, it was reported 2.93 kg improvement in the resistance band group, while the radar gun test showed +1.60 kph improvement which was less than the weight group but higher than the control group. Even though the results of the 1RM Bench press in the control group reported +1.70 kg, there was a minus influence on

the throwing velocity which was recorded as -0.50 kph.

The results of the independent sample t-test for 1 RM Bench press showed 0.003, 0.000, 0.000, significance differences (0.05) between both pre and post-tests data in the control group, weight training group, and resistance band group respectively. However, although there was a significant difference in the upper body strength of the control group, throwing velocity showed no significant improvement )0.381> p( whereas the null hypothesis )H<sub>01</sub> (was accepted. Moreover, the weight training group reported 0.000 which was less than 0.05 for the radar gun test, and the null

hypothesis was rejected and the alternative hypothesis Ha2) There is a significant impact of weight training programs on throwing velocity (was accepted .Also, 0.010 significant difference was recorded in the radar gun test of the resistance band training group, which was also less than 0.05 and rejected the null hypothesis, and accepted the Ha3) There is a significant impact of resistance band training programs on throwing velocity.(

#### **4 CONCLUSION**

The purpose of this study was to determine the effect of the resistance band and weight training programs on throwing velocity as well as to identify how upper body strength would relate to throwing velocity. The radar gun test was performed to measure the throwing velocity after and before training programs, while the 1RM bench press test was conducted to measure participants' upper body strength. The results showed that during the 8-week training programs, the upper body weight training program was the most effective training method to develop throwing velocity as well as the upper body strength. Moreover, the resistance band training group also reported a positive influence on the strength and throwing velocity, but the degrees of both tests were lower than those of the weight training group. Nevertheless, eventhough there was a slight improvement of strength in the control group, surprisingly it was reported that there was no significant difference between post-test and pre-test results in the radar gun test. A study by Newton and McEvoy in 1994 stated that throwing action, force output, and rate of force development could influence throwing

velocity eventhough strength has gained. Perhaps those factors would have affected the output of the control group. Furthermore, during the intervention, subjects' participation in baseball practices was not measured under the training variables such as intensity, type of training, and volume. Therefore, those factors might have influenced the improvement of strength in the control group.

Some studies such as Hermassi et al in 2010 and Newton and McEvoy in 1994 suggest that weight training is the most important factor for the development of strength and throwing velocity, whereas others (Escamilla et al., 2010, Carter et al., 2007) claim it can be done by using resistance bands (surgical tubes), calisthenics training and functional training. But, based on the findings of this study, both strength training and resistance band training would be ideal to develop both strength and throwing velocity among athletes, especially in throwing sports. Additionally, coaches and other professionals should be mindful about the selection of training methods to develop strength and throwing velocity as both types of training have a different influence on the strength and throwing velocity. Not only the strength, but also some factors like throwing action, throwing mechanism, diet, and muscle stretch-shortening cycle would be affected for strength and throwing performances which were not evaluated in this study.

In summary, it was shown that the majority of training methods such as weight training and resistance band training were able to develop throwing velocity as a result of strength development. Furthermore, this

finding can be applied to develop throwing velocity by using weight training and resistance band training in Sri Lanka. However, further studies should be conducted to determine both advantages and disadvantages of weight training and resistance band training along with the variety of different exercises according to sports and individuals that suit Sri Lanka baseball players.

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