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Velocity Based Training and the Effects on In-season Baseball Athletes

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VELOCITY BASED TRAINING AND THE EFFECTS ON IN-SEASON BASEBALL ATHLETES

by

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CHAPTER ONE

INTRODUCTION

When it comes to barbell strength training with collegiate explosive athletes, the focus is first on giving them a good base of strength. Once this is gained, the focus moves to various explosive movements, which includes focusing on the speed of the bar rather just continuing on loading more weight on the bar on squat, bench, and deadlift. Baseball is a sport that frequently incorporates explosive movement in all the functional movements required to see success. Baseball athlete require power production when throwing the baseball or swinging the bat. The term "explosive" is qualified by the amount of power that the athlete can create, which in turn allows for the athlete to move at higher velocities due to the increase in power output.

One of the ways that this type of training can be incorporated is through dynamic barbell training. This type of training focuses on the speed of the barbell during squat, bench, and power clean movements. The tracking of the velocity, force, and power output of the movements is uncovered by Tendo and GymAware PowerTool velocity trackers. As stated by Baechle and Earle (2008), "velocity specificity is really the final movement velocity targeted when mass is being accelerated" (p.460). Lastly, "power is precisely defined as the time rate if doing work" (p. 74). The more velocity that is created throughout the training cycles, the greater the improvement when it comes to power and explosive movements, and therefore, the better performance overall. Studies have shown positive results from using similar training methods when working with athletes of all ages and in many different sports. Badillo, Blanco, Rosell, Abad-Herencia, Lopez, and Sanchez (2014) found that, "velocity-based resistance training with moderate load and few repetitions per set seems to be an adequate methodology to improve the physical performance in young soccer players" (p. 1). Similarly, Mann, Ivey, and Sayers (2015)

"velocity-based training has demonstrated tangible improvements in the power production, which is the key to improving on-field performance in the collegiate football player" (p. 56).

Literature Review

With velocity-based training being a more recent approach to performance training for athlete has become more popular training style across many sport. This type of training focuses on the speed at which the bar moves rather than just how much weight can be lifted. The study done by Badillo et al. (2014) found that, "velocity-based resistance training with moderate load and few repetitions per set seems to be an adequate methodology to improve the physical performance in young soccer players" (p. 1). This study incorporated velocity based training in conjunction with plyometric variations and sprinting, with a collected group of youth soccer players. Badillo and colleagues set up the participants of the experiment with 17 athletes in the under-16 age group and 16 athletes in the under-18 age group. These groups were a part of the study that involved a 26-week program incorporating the maximal velocity resistant training. There was also a control group included in the study that did not include the resistance training with 11 athletes on the under-21 team. The study tested all the groups with a 20 m sprint, countermovement jump, and a progressive isoinertial lading test. This study allowed for the illustration of how to compare the groups and effectively demonstrated the importance and the process of improving power output through velocity based training as there was greater improvement with the countermovement jump with the under-16 and under-18 groups compared to the under-21 control group.

While research has shown that velocity based training is an efficient way of improving power output in many sports, one that has shown particular benefits is football. Highlighted by Mann, Ivey, and Sayers (2015), "velocity-based training has demonstrated tangible

improvements in the power production, which is the key to improving on-field performance in the collegiate football player" (p. 56). This study allowed for people to examine velocity-based training within the sport of collegiate football, and demonstrated the importance of quality of training when incorporating velocity based training. This research established that a proper amount of stress being placed on the body allows for the constant improvement and a viable way to effectively train in different parts of the season. This was accomplished by the study using tracking unit to monitor the speed of the bar. This allows for the coaches to tell if there is too much stress for the athlete in that given training session. If the athletes did not stay in the speed zone for the weight being use, adjustments were made to the load. Velocity based training allows for the coaches to tell how the athletes central nervous system and body is handling the other factors of life on top of the training. With baseball being an explosive sport, as football is, it is reasonable to use this study as an illustration of how to improve power output and continue these improvements throughout different parts of the sporting seasons.

Not only is velocity based training important for the improvement of power output, it is also important for the optimal training of the athletes. According to Jovanovic and Flanagan (2014) "utilizing velocity stops in a given set allows the control of fatigue and exertion during strength training. Velocity monitoring also provides immediate real-time feedback which research suggests motivates athletes to apply consistent maximal lifting effort which has been associated with positive training effects" (p. 68). When incorporating velocity based training into a program, it is important to have a load/velocity profile for the athletes. Load/velocity profile is a profile that allow for instructors to determine based off the load how fast or with how much velocity it should be moved, as well as allowing for one to predict an athlete 1-rep max on any lift. This information was found for the athletes in this study by having them perform repetitions

on all the exercises being tested and by varying loads. These changes in loads allowed for the tester to figure a mean velocity for the athletes across the varying loads. Similarly, exertion/velocity profiles have been used to evaluate for positive day to day training. During this evaluation, the focus was on various velocities and the exertion levels of the athletes during the movements of squat, bench or deadlift. Combining both these two types of evaluations to training allows for the coaches to control the fatigue and exertion throughout training sessions.

The improvement of power can also be improved for the explosive sport of golf. In the study by Schofield (2015) the author illustrated that "power training within golf is a valid method of increasing club head speed" (p. 12). These two golfers were placed in a six-week training intervention, where they trained three times per week. During these training sessions, the focus centered on improving the power of these golfers, which came in the form of upper body press, upper body pull, and squat movement. As the researchers focused on these factors during the training sessions, the post evaluation showed that there was an improvement in the club head speed in the conclusion of the training. "Increasing rotational velocity should be a primary focus within golf specific strength and conditioning" (Schofield, 2015, p. 12). This conclusion was assessed and finalized through the isometric med-thigh pull, which was tested with chain fixation, which assisted in the uncovering of rapid force production. The other source of test came in the form of a cable down swing, which was used to test the club velocity over the duration of the study.

Rugby is another sport that requires explosive movement and power to function in the sport and find success. In an article by Gurdeep Singh (2016) on velocity based training with rugby athletes, the author found that, "this investigation provides evidence that performing isoinertial resistance training within specific VBT zones may be an effective training stimulus to

enhance neuromuscular strength and power performance whilst limiting excessive fatigue in professional rugby league players" (p. 14). During this study, the rugby players were put through a five-week velocity training program. Throughout these five weeks, the athletes were tracked and data recorded based on their velocities and the outcomes from the neuromuscular strength and power progression. The main exercise evaluated during this study were: the bench, back squat, and power clean. From these different exercises and the training program, there needs to be a pre-test and post-test to help evaluate the progression of the athletes. This study used: countermovement jumps, squat jumps, and three repetitions maximum for the given exercises. When going through velocity based training a strength and power progression or periodization should be put into place, thus, throughout this study from each week a certain load was used and these researchers tracked the velocities for every given load, and recorded if they maintain that speed zone.

Research by Banyard, Tufano, Delgado, Thomson, and Nosaka (2018) has shown that "velocity-based training permits faster velocities, avoids additional unnecessary mechanical stress but maintains similar measures of force and power output compared to strength-oriented percentage-based training" (p. 1). The 15 male participants of this study were taken through four randomized training sessions, which involved performing 5 sets of 5 repetitions of each exercise. During these sets, the velocity of weight was examined during this experiment and the weights were changed when the participant achieved the target velocity. When the velocity of the 80% loaded dropped below the threshold of 20% velocity, the sets were dismissed. This evaluation of velocity gave the understanding of mechanical stress and what the body can handle on any given day, which can then be used to establish daily training programs. This training program would be implemented by the strength coach to make sure the athlete is going to make the correct and

proper progression that is needed.

When more closely examining the tools that are going to be used for the velocity, force, and power output from the barbell movements for explosive athletes (e.g., football and baseball), the GymAware PowerTool (GYM) is a tracking tool that allows for these different output components. Research conducted by Orange, Metcalfe, Marshall, Vince, Madden, and Liefeith (2018) found, "GYM provides practitioners with reliable kinematic information in the back squat and bench press, at least with loads of 40 to 90% of 1RM" (p. 2). This equipment is a great tool to allow for strength coaches to better understand and visualize the velocity of each of the movements. It helps to see the capability of being able to regulate training loads information to match force and velocity together for proper training levels. Similarly, Tendo unit and many other units track velocity and give you accurate numbers for velocity, power, and force measurements. In a study by Lorenzetti, Lamparter, and Luthy (2017), "all the linear position transducers were able to assess squat performance, particularly during traditional squats and especially in terms of mean velocity and time to maximal velocity" (p. 1). Throughout this research, the focus is on the squat movement and the velocity of the movement when tracked by varies tracking devices. This insight is due to the many tracers that allowed for the increased reliability of the velocity tracking in either of the movements used.

The sport of baseball is a very explosive sport thus the need for power is highly important and with the function of tracking systems being able to assess power output, more research is needed to further clarify the relationship between the two and how this knowledge can benefit strength coaches and athletes alike.

Purpose

The purpose of the current study was to determine if there will be an increase to power

output from the lower extremities of collegiate baseball athletes after velocity-based barbell training. The velocity-based training will be implemented into the regular strength training program followed by the team. The specific research question is: will velocity-based training lead to an increase or maintain velocity residuals from the lower extremities in baseball players during the in-season training? The hypothesis is that velocity-based barbell training will lead to an increase or the ability to maintain the residuals of velocity in the lower extremities for baseball player during the season of play compared to unaccompanied general strength training. Participants used for this study had been male athletes from an NCAA Division I baseball program at Southern Illinois University at Carbondale. With these athletes, I had assessed their velocity on barbell movements by the use of Tendo and GymAware velocity unit trackers. These units tracked the velocity and force that is being created with each repetition. The main tool of this study was a regular training barbell, along with the weights that were loaded on to the barbell and measured in pounds.

CHAPTER TWO

METHOD

Participants

The participants used in this study came from an NCAA Division I baseball team. There were 5 participants from the pitchers on the baseball team. There were five participants from the infielders of the baseball team, and five of the participants were from the outfielder position. With the selected participants, there was an age range from 20 to 23 years old. Each of the participants were considered to have a high fitness level due to their regular physical training/conditioning and sport activity. Athletes selected have been in the program for three to four years and have a greater training age than the others. The training age of the athlete has no correlation with their chronological age, but on the number of years they have been on a regular training program. All of the participants were assumed to have high sport skill levels due to the fact that they are all Division I athletes, making them part of the top level of collegiate athletes. Due to the fact that this sport is an explosive sport, it puts each position that was selected for this study in similar physical requirement categories. The sampling style used for this selection was quota sampling, which came down to the specific characteristics that were needed to fit for both rotational and explosive characteristics. Due to my position as their strength coach, it is my job to design their training programs. That being said, another member of the strength and conditioning staff informed them on what the research would be and if they would be interested in being a part of it. During this process, they were also informed on the benefits of the type of velocity based training that would take place.

Materials

During this study, two types of velocity trackers were used. One being a Tendo unit,

which is a unit that lays on the ground and has a string that ascends and attaches to the bar. As the string moves with the movement and the speed of the bar, it tracks the force, power, and velocity of the specific movement. The information from the string is converted into a tracking unit that allows for the participants to see these measurements as they are completed. The other velocity tracker that was used was the GymAware velocity tracking system, which comes in the form of a Bluetooth system. There is a still a cord connected to the bar, but the system spitting out the information of power and velocity is a Bluetooth. This transfers the information on to an IPad which allows for me to see the different measurements of the movement. The GymAware is a Bluetooth so it feeds all the information to the app for further use and tracking capabilities.

The Texas Power Bar was used as the loading material for the squat pattern in this experiment. This specific bar is meant for the squatting movement which allows us for us to have the proper material for this type of movement. The bar was loaded by Intech weights that were measured in pounds. Which allowed for us to get the appropriate weight needed for each specific athlete. When it comes to the pre-testing and post testing, the material of a Verta mat was used in order to track the leg power output. This gives us the ability to track the amount of power that can be created. This Verta mat calculates and transmits the vertical max numbers out on to a hand-held device, which is then recorded. Also, the 10-yard split time was another tracker of the velocity of the athletes. Lastly, there were clips used assisting in keeping the weight on the bar bell as we go through each specific movement.

Procedure

Before the study started, I received approval from the Southern Illinois University at Carbondale Human Research Committee that this project was approved. This study started off with a pre-test of their vertical max which illustrated their power output from their lower

extremities. Their one rep max was also found as a part of the pre-testing. Once this was completed, the 8-week program was started. Which included general strength training and variations of velocity based training. During the process of velocity-based training, the tools of the Tendo unit and GymAware were used to collect the data on movement of the bar. During this program, the percentages of which the velocity based training was based on, increased based of the velocity measurement that was recorded. From these velocities numbers, there was a load/ velocity profile that was created for each specific athlete. The load velocity profile was conducted by 2-3 repetitions at 30-40% of their one rep max, 2 reps at 40-50%, 1 to 2 reps at 60-70%, 1 rep at 70-80%, and 1-rep at 80-85%. From this, it allowed for me to find their mean velocity.

Similarly, an exertion velocity profile was created for each of the athletes. This came in the form of rating the difficulty level from one to ten telling how difficult the set was. Based off of the velocity which was created from the rep. Once the 8- week program was finished, the athletes were put through post testing of their vertical max on the Verta mat and 10-yard split. From these numbers, I compared the pre-testing to post testing to see the changes in the lower extremity power output and the residuals of velocity. These comparisons showed the percentages of change from the beginning of the velocity based program to the end.

Design and Analysis

Within this descriptive study, the independent variable comes in the form of the load that is given to each specific athlete. The load comes in the form of their percent of their one repetition maximum. This was the load that was measured by the velocity trackers with the amount of velocity that can be created with this type of load. For the dependent variable for this experiment, velocity and power measurements were used. These measurements were

gathered through the two velocity trackers. Another dependent variable that was measured was the exertion level of the athletes, by reporting their exhaustion level after every given exercise. The controlled variables in this study were the volume of the exercises which came in the form of the number of repetitions and sets for each exercise. For this study, there was a within-subject design and this came in the form of all of the participants experiencing similar stresses and loads. The loads were projected from their percentage of their 1-rep max. The results are presented in descriptive form.

CHAPTER THREE

RESULTS

Week 1 Results

Week one of the program started with 3 sets of 5 reps with 70 percent of their max of their squat for the strength day. Throughout this training session the athletes were to stay within the velocity range of .70 m/s to .75 m/s. Pitcher one (P1) averaged .727 m/s throughout all the sets for the day. Pitcher two (P2) averaged .71 m/s throughout all the sets for the day. Pitcher three (P3) averaged .737 m/s throughout all the sets for the day. Pitcher four (P4) averaged .723 m/s throughout all the sets for the day. Pitcher five (P5) averaged .733 m/s throughout all the sets for the day. Infielder one (INF1) averaged .75 m/s throughout all the sets for the day. Infielder two (INF2) averaged .743 m/s throughout all the sets for the day. Infielder three (INF3)averaged .733 m/s throughout all the sets for the day. Infielder four (INF4) averaged .75 m/s throughout all the sets for the day. Infielder five (INF5) averaged .713 m/s throughout all the sets for the day. Outfielder one (OUT1) averaged .763 m/s throughout all the sets for the day. Outfield two (OUT2) averaged .727 m/s throughout all the sets for the day. Outfielder three (OUT3) averaged .72 m/s throughout all the sets for the day. Outfielder four (OUT4) averaged .717 m/s throughout all the sets for the day. Outfielder five (OUT5) averaged .707 m/s throughout all the sets for the day.

For the dynamic or speed day of Week 1, we started with 8 sets of 2 reps at the load of 40 percent of their max of their squat. Throughout this training session the athletes were instructed to stay within the velocity range of .90 m/s to 1.2 m/s. P1 averaged .98 m/s throughout all the sets for the day. P2 averaged .96 m/s throughout all the sets for the day. P3 averaged 1.2 m/s throughout all the sets for the day. P4 averaged .97 m/s throughout all the sets for the day. P5

averaged .98 m/s throughout all the sets for the day. INF1 averaged 1.1 m/s throughout all the sets for the day. INF2 averaged 1.1 m/s throughout all the sets for the day. INF3 averaged .99 m/s throughout all the sets for the day. INF4 averaged 1.1 m/s throughout all the sets for the day. INF5 averaged .98 m/s throughout all the sets for the day. OUT1 averaged 1.0 m/s throughout all the sets for the day. OUT2 averaged .98 m/s throughout all the sets for the day. OUT3 averaged .97 m/s throughout all the sets for the day. OUT4 averaged 1.0 m/s throughout all the sets for the day. OUT5 averaged .99 m/s throughout all the sets for the day.

Week 2 Results

Week two of the program started with 3 sets of 3 rep with 77.5 percent of their max of their squat for the strength day. Throughout this training session, the athletes were instructed (expected) to stay within the velocity range of .65 m/s to .75 m/s. P1 averaged .71 m/s throughout all the sets for the day. P2 averaged .703 m/s throughout all the sets for the day. P3 averaged .713 m/s throughout all the sets for the day. P4 averaged .707 m/s throughout all the sets for the day. P5 averaged .707 m/s throughout all the sets for the day. INF1 averaged .723 m/s throughout all the sets for the day. INF2 averaged .72 m/s throughout all the sets for the day. INF3 averaged .72 m/s throughout all the sets for the day. INF4 averaged .70 m/s throughout all the sets for the day. INF5 averaged .70 m/s throughout all the sets for the day. OUT1 averaged .717 m/s throughout all the sets for the day. OUT2 averaged .72 m/s throughout all the sets for the day. OUT3 averaged .713 m/s throughout all the sets for the day. OUT4 averaged .723 m/s throughout all the sets for the day. OUT5 averaged .713 m/s throughout all the sets for the day.

For the dynamic or speed day we started with 8 sets of 2 reps at the load of 40 percent of their max of their squat. Throughout this training session the athletes were instructed to stay around the velocity range of .90 m/s to 1.2 m/s. P1 averaged 1.0 m/s throughout all the sets for

the day. P2 averaged 1.0 m/s throughout all the sets for the day. P3 averaged 1.15 m/s throughout all the sets for the day. P4 averaged 1.0 m/s throughout all the sets for the day. P5 averaged 1.1 m/s throughout all the sets for the day. INF1 averaged 1.15 m/s throughout all the sets for the day. INF2 averaged 1.12 m/s throughout all the sets for the day. INF3 averaged 1.11 m/s throughout all the sets for the day. INF4 averaged 1.15 m/s throughout all the sets for the day. INF5 averaged 1.1 m/s throughout all the sets for the day. OUT1 averaged 1.15 m/s throughout all the sets for the day. OUT2 averaged 1.0 m/s throughout all the sets for the day. OUT3 averaged 1.0 m/s throughout all the sets for the day. OUT4 averaged 1.12 m/s throughout all the sets for the day. OUT5 averaged 1.05 m/s throughout all the sets for the day.

Week 3 Results

Week 3 of the program started with 3 sets of 5 reps with 72.5 percent of their max of their squat for the strength day. Throughout this training session the athletes were instructed to stay within the velocity range of .60 m/s to .70 m/s. P1 averaged .623 m/s throughout all the sets for the day. P2 averaged .64 m/s throughout all the sets for the day. P3 averaged .633 m/s throughout all the sets for the day. P4 averaged .63 m/s throughout all the sets for the day. P5 averaged .623 m/s throughout all the sets for the day. INF1 averaged .647 m/s throughout all the sets for the day. INF2 averaged .653 m/s throughout all the sets for the day. INF3 averaged .617 m/s throughout all the sets for the day. INF4 averaged .643 m/s throughout all the sets for the day. INF5 averaged .61 m/s throughout all the sets for the day. OUT1 averaged .617 m/s throughout all the sets for the day. OUT2 averaged .63 m/s throughout all the sets for the day. OUT3 averaged .633 m/s throughout all the sets for the day. OUT4 averaged .633 m/s throughout all the sets for the day. OUT5 averaged .62 m/s throughout all the sets for the day.

For the dynamic or speed day we started with 10 sets of 2 reps at the load of 40 percent of

their max of their squat. Throughout this training session the athletes were instructed to stay around the velocity range of .90 m/s to 1.2 m/s. P1 averaged 1.0 m/s throughout all the sets for the day. P2 averaged .99 m/s throughout all the sets for the day. P3 averaged 1.15 m/s throughout all the sets for the day. P4 averaged 1.0 m/s throughout all the sets for the day. P5 averaged 1.1 m/s throughout all the sets for the day. INF1 averaged 1.15 m/s throughout all the sets for the day. INF2 averaged 1.12 m/s throughout all the sets for the day. INF3 averaged 1.11 m/s throughout all the sets for the day. INF4 averaged 1.15 m/s throughout all the sets for the day. INF5 averaged 1.1 m/s throughout all the sets for the day. OUT1 averaged 1.15 m/s throughout all the sets for the day. OUT1 averaged 1.0 m/s throughout all the sets for the day. OUT3 averaged 1.0 m/s throughout all the sets for the day. OUT4 averaged 1.12 m/s throughout all the sets for the day. OUT5 averaged 1.05 m/s throughout all the sets for the day.

Week 4 Results

Week four of the program started with 3 sets of 3 rep with 80 percent of their max of their squat for the strength day. Throughout this training session the athletes were instructed to stay within the velocity range of .50 m/s to .55 m/s. P1 averaged .53 m/s throughout all the sets for the day. P2 averaged .52 m/s throughout all the sets for the day. P3 averaged .537 m/s throughout all the sets for the day. P4 averaged .52 m/s throughout all the sets for the day. P5 averaged .523 m/s throughout all the sets for the day. INF1 averaged .523 m/s throughout all the sets for the day. INF2 averaged .537 m/s throughout all the sets for the day. INF3 averaged .51 m/s throughout all the sets for the day. INF4 averaged .513 m/s throughout all the sets for the day. INF5 averaged .51 m/s throughout all the sets for the day. OUT1 averaged .507 m/s throughout all the sets for the day. OUT1 averaged .507 m/s throughout all the sets for the day. OUT3 averaged .537 m/s throughout all the sets for the day. OUT4 averaged .507 m/s

throughout all the sets for the day. OUT5 averaged .507 m/s throughout all the sets for the day.

For the dynamic or speed day we started with 8 sets of 2 reps at the load of 45 percent of their max of their squat. Throughout this training session the athletes were instructed to stay within the velocity range of .90 m/s to 1.0 m/s. P1 averaged .96 m/s throughout all the sets for the day. P2 averaged .93 m/s throughout all the sets for the day. P3 averaged .98 m/s throughout all the sets for the day. P4 averaged .93 m/s throughout all the sets for the day. P5 averaged .95 m/s throughout all the sets for the day. INF1 averaged .98 m/s throughout all the sets for the day. INF2 averaged .99 m/s throughout all the sets for the day. INF3 averaged .96 m/s throughout all the sets for the day. INF4 averaged .98 m/s throughout all the sets for the day. INF5 averaged .93 m/s throughout all the sets for the day. OUT1 averaged .99 m/s throughout all the sets for the day. OUT1 averaged .94 m/s throughout all the sets for the day. OUT3 averaged .92 m/s throughout all the sets for the day. OUT4 averaged .97 m/s throughout all the sets for the day. OUT5 averaged .94 m/s throughout all the sets for the day.

Week 5 Results

Week five of the program started with 3 sets of 4 rep with 75 percent of their max of their squat for the strength day. Throughout this training session the athletes were instructed to stay around the velocity range of .60 m/s to .70 m/s. P1 averaged .703 m/s throughout all the sets for the day. P2 averaged .697 m/s throughout all the sets for the day. P3 averaged .70 m/s throughout all the sets for the day. P4 averaged .693 m/s throughout all the sets for the day. P5 averaged .693 m/s throughout all the sets for the day. INF1 averaged .717 m/s throughout all the sets for the day. INF2 averaged .713 m/s throughout all the sets for the day. INF3 averaged .697 m/s throughout all the sets for the day. INF4 averaged .697 m/s throughout all the sets for the day. INF5 averaged .683 m/s throughout all the sets for the day. OUT1 averaged .697 m/s throughout

all the sets for the day. OUT1 averaged .70 m/s throughout all the sets for the day. OUT3 averaged .693 m/s throughout all the sets for the day. OUT4 averaged .703 m/s throughout all the sets for the day. OUT5 averaged .693 m/s throughout all the sets for the day.

For the dynamic or speed day we started with 8 sets of 2 reps at the load of 45 percent of their max of their squat. Throughout this training session the athletes were instructed to stay around the velocity range of .90 m/s to 1.0 m/s. P1 averaged .97 m/s throughout all the sets for the day. P2 averaged .95 m/s throughout all the sets for the day. P3 averaged .99 m/s throughout all the sets for the day. P4 averaged .94 m/s throughout all the sets for the day. P5 averaged .97 m/s throughout all the sets for the day. INF1 averaged 1.0 m/s throughout all the sets for the day. INF2 averaged 1.0 m/s throughout all the sets for the day. INF3 averaged .98 m/s throughout all the sets for the day. INF4 averaged .99 m/s throughout all the sets for the day. INF5 averaged .95 m/s throughout all the sets for the day. OUT1 averaged 1.0 m/s throughout all the sets for the day. OUT1 averaged .96 m/s throughout all the sets for the day. OUT3 averaged .95 m/s throughout all the sets for the day. OUT4 averaged .99 m/s throughout all the sets for the day. OUT5 averaged .96 m/s throughout all the sets for the day.

Week 6 Results

Week 6 of the program started with 3 sets of 2 reps with 82.5 percent of their max of their squat for the strength day. Throughout this training session the athletes were instructed to stay within the velocity range of .45 m/s to .55 m/s. P1 averaged .51 m/s throughout all the sets for the day. P2 averaged .513 m/s throughout all the sets for the day. P3 averaged .517 m/s throughout all the sets for the day. P4 averaged .517 m/s throughout all the sets for the day. P5 averaged .51 m/s throughout all the sets for the day. INF1 averaged .50 m/s throughout all the sets for the day. INF2 averaged .51 m/s throughout all the sets for the day. INF3 averaged .497

m/s throughout all the sets for the day. INF4 averaged .50 m/s throughout all the sets for the day. INF5 averaged .503 m/s throughout all the sets for the day. OUT1 averaged .503 m/s throughout all the sets for the day. OUT1 averaged .49 m/s throughout all the sets for the day. OUT3 averaged .517 m/s throughout all the sets for the day. OUT4 averaged .503 m/s throughout all the sets for the day. OUT5 averaged .50 m/s throughout all the sets for the day.

For the dynamic or speed day we started with 10 sets of 2 reps at the load of 45 percent of their max of their squat. Throughout this training session the athletes were instructed to stay within the velocity range of .90 m/s to 1.0 m/s. P1 averaged .97 m/s throughout all the sets for the day. P2 averaged .95 m/s throughout all the sets for the day. P3 averaged .99 m/s throughout all the sets for the day. P4 averaged .94 m/s throughout all the sets for the day. P5 averaged .97 m/s throughout all the sets for the day. INF1 averaged 1.0 m/s throughout all the sets for the day. INF2 averaged 1.0 m/s throughout all the sets for the day. INF3 averaged .98 m/s throughout all the sets for the day. INF4 averaged .99 m/s throughout all the sets for the day. INF5 averaged .95 m/s throughout all the sets for the day. OUT1 averaged 1.0 m/s throughout all the sets for the day. OUT1 averaged .96 m/s throughout all the sets for the day. OUT3 averaged .95 m/s throughout all the sets for the day. OUT4 averaged .99 m/s throughout all the sets for the day. OUT5 averaged .96 m/s throughout all the sets for the day.

Week 7 Results

Week 7 of the program started with 3 sets of 4 reps with 77.5 percent of their max of their squat for the strength day. Throughout this training session the athletes were instructed to stay within the velocity range of .60 m/s to .70 m/s. P1 averaged .683 m/s throughout all the sets for the day. P2 averaged .677 m/s throughout all the sets for the day. P3 averaged .68 m/s throughout all the sets for the day. P4 averaged .67 m/s throughout all the sets for the day. P5 averaged .667

m/s throughout all the sets for the day. INF1 averaged .69 m/s throughout all the sets for the day. INF2 averaged .677 m/s throughout all the sets for the day. INF3 averaged .667 m/s throughout all the sets for the day. INF4 averaged .667 m/s throughout all the sets for the day. INF5 averaged .663 m/s throughout all the sets for the day. OUT1 averaged .67 m/s throughout all the sets for the day. OUT1 averaged .63 m/s throughout all the sets for the day. OUT3 averaged .66 m/s throughout all the sets for the day. OUT4 averaged .667 m/s throughout all the sets for the day. OUT5 averaged .667 m/s throughout all the sets for the day.

For the dynamic or speed day we started with 8 sets of 2 reps at the load of 50 percent of their max of their squat. Throughout this training session the athletes were instructed to stay within the velocity range of .90 m/s to 1.0 m/s. P1 averaged .93 m/s throughout all the sets for the day. P2 averaged .91 m/s throughout all the sets for the day. P3 averaged .96 m/s throughout all the sets for the day. P4 averaged .90 m/s throughout all the sets for the day. P5 averaged .95 m/s throughout all the sets for the day. INF1 averaged .96 m/s throughout all the sets for the day. INF2 averaged .99 m/s throughout all the sets for the day. INF3 averaged .96 m/s throughout all the sets for the day. INF4 averaged .97 m/s throughout all the sets for the day. INF5 averaged .93 m/s throughout all the sets for the day. OUT1 averaged .98 m/s throughout all the sets for the day. OUT1 averaged .94 m/s throughout all the sets for the day. OUT3 averaged .92 m/s throughout all the sets for the day. OUT4 averaged .96 m/s throughout all the sets for the day. OUT5 averaged .93 m/s throughout all the sets for the day.

Week 8 Results

Week 8 of the program started with 3 sets of 2 reps with 85 percent of their max of their squat for the strength day. Throughout this training session the athletes were instructed to stay within the velocity range of .40 m/s to .50 m/s. P1 averaged .463 m/s throughout all the sets for

the day. P2 averaged .453 m/s throughout all the sets for the day. P3 averaged .453 m/s throughout all the sets for the day. P4 averaged .437 m/s throughout all the sets for the day. P5 averaged .45 m/s throughout all the sets for the day. INF1 averaged .467 m/s throughout all the sets for the day. INF2 averaged .45 m/s throughout all the sets for the day. INF3 averaged .447 m/s throughout all the sets for the day. INF4 averaged .46 m/s throughout all the sets for the day. INF5 averaged .477 m/s throughout all the sets for the day. OUT1 averaged .473 m/s throughout all the sets for the day. OUT1 averaged .453 m/s throughout all the sets for the day. OUT3 averaged .473 m/s throughout all the sets for the day. OUT4 averaged .473 m/s throughout all the sets for the day. OUT5 averaged .473 m/s throughout all the sets for the day.

For the dynamic or speed day we started with 8 sets of 2 reps at the load of 50 percent of the max of their squat. Throughout this training session the athletes were instructed to stay within the velocity range of .90 m/s to 1.0 m/s. P1 averaged .94 m/s throughout all the sets for the day. P2 averaged .93 m/s throughout all the sets for the day. P3 averaged .98 m/s throughout all the sets for the day. P4 averaged .92 m/s throughout all the sets for the day. P5 averaged .97 m/s throughout all the sets for the day. INF1 averaged .99 m/s throughout all the sets for the day. INF2 averaged 1.0 m/s throughout all the sets for the day. INF3 averaged .99 m/s throughout all the sets for the day. INF4 averaged .98 m/s throughout all the sets for the day. INF5 averaged .93 m/s throughout all the sets for the day. OUT1 averaged .99 m/s throughout all the sets for the day. OUT1 averaged .93 m/s throughout all the sets for the day. OUT3 averaged .91 m/s throughout all the sets for the day. OUT4 averaged .98 m/s throughout all the sets for the day. OUT5 averaged .94 m/s throughout all the sets for the day.

Table 1: Velocity-Based Heavy Strength Training Sessions

Velcoity-Based Strength Day															
WEEK 1	Pitcher #1	Pitcher #2	Pitcher #3	Pitcher #4	Pitcher #5	Infielder #1	Infielder #2	Infielder #3	Infielder #4	Infielder #5	OutFielder #1	OutFielder #2	OutFielder #3	OutFielder #4	OutFielder #5
3 Sets	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1
	Avg. 0.75	Avg. 0.71	Avg. 0.75	Avg. 0.72	Avg. 0.75	Avg. 0.77	Avg. 0.75	Avg. 0.75	Avg. 0.72	Avg. 0.71	Avg. 0.77	Avg. 0.75	Avg. 0.73	Avg. 0.71	Avg. 0.70
5 Reps	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2
	Avg. 0.71	Avg. 0.72	Avg. 0.73	Avg. 0.74	Avg. 0.73	Avg. 0.74	Avg. 0.75	Avg. 0.73	Avg. 0.74	Avg. 0.71	Avg. 0.77	Avg. 0.71	Avg. 0.71	Avg. 0.71	Avg. 0.71
70%	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3
	Avg. 0.72	Avg. 0.70	Avg. 0.73	Avg. 0.71	Avg. 0.72	Avg. 0.74	Avg. 0.73	Avg. 0.72	Avg. 0.74	Avg. 0.72	Avg. 0.75	Avg. 0.72	Avg. 0.72	Avg. 0.73	Avg. 0.71
WEEK 2															
3 Sets	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1
	Avg. 0.62	Avg. 0.62	Avg. 0.63	Avg. 0.61	Avg. 0.62	Avg. 0.66	Avg. 0.66	Avg. 0.62	Avg. 0.65	Avg. 0.60	Avg. 0.62	Avg. 0.62	Avg. 0.63	Avg. 0.65	Avg. 0.62
3 Reps	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2
	Avg. 0.63	Avg. 0.65	Avg. 0.63	Avg. 0.64	Avg. 0.63	Avg. 0.63	Avg. 0.65	Avg. 0.62	Avg. 0.63	Avg. 0.61	Avg. 0.61	Avg. 0.64	Avg. 0.63	Avg. 0.63	Avg. 0.61
77.5%	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3
	Avg. 0.62	Avg. 0.65	Avg. 0.64	Avg. 0.64	Avg. 0.62	Avg. 0.65	Avg. 0.65	Avg. 0.61	Avg. 0.65	Avg. 0.62	Avg. 0.62	Avg. 0.63	Avg. 0.64	Avg. 0.62	Avg. 0.63
WEEK 3															
3 Sets	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1
	Avg. 0.73	Avg. 0.72	Avg. 0.74	Avg. 0.72	Avg. 0.71	Avg. 0.74	Avg. 0.73	Avg. 0.72	Avg. 0.70	Avg. 0.70	Avg. 0.72	Avg. 0.73	Avg. 0.72	Avg. 0.73	Avg. 0.72
5 Reps	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2
	Avg. 0.7	Avg. 0.69	Avg. 0.71	Avg. 0.70	Avg. 0.71	Avg. 0.71	Avg. 0.71	Avg. 0.71	Avg. 0.71	Avg. 0.71	Avg. 0.71	Avg. 0.71	Avg. 0.71	Avg. 0.72	Avg. 0.72
72.5%	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3
	Avg. 0.70	Avg. 0.70	Avg. 0.69	Avg. 0.70	Avg. 0.70	Avg. 0.72	Avg. 0.72	Avg. 0.73	Avg. 0.69	Avg. 0.69	Avg. 0.72	Avg. 0.72	Avg. 0.71	Avg. 0.72	Avg. 0.70
WEEK 4															
3 Sets	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1
	Avg. 0.55	Avg. 0.52	Avg. 0.55	Avg. 0.53	Avg. 0.52	Avg. 0.53	Avg. 0.55	Avg. 0.50	Avg. 0.51	Avg. 0.52	Avg. 0.51	Avg. 0.52	Avg. 0.55	Avg. 0.50	Avg. 0.51
3 Reps	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2
	Avg. 0.53	Avg. 0.53	Avg. 0.53	Avg. 0.53	Avg. 0.53	Avg. 0.53	Avg. 0.53	Avg. 0.52	Avg. 0.51	Avg. 0.50	Avg. 0.51	Avg. 0.50	Avg. 0.54	Avg. 0.51	Avg. 0.51
80%	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3
	Avg. 0.51	Avg. 0.51	Avg. 0.53	Avg. 0.50	Avg. 0.52	Avg. 0.51	Avg. 0.53	Avg. 0.51	Avg. 0.52	Avg. 0.51	Avg. 0.50	Avg. 0.50	Avg. 0.52	Avg. 0.51	Avg. 0.50
WEEK 5															
3 Sets	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1
	Avg. 0.71	Avg. 0.71	Avg. 0.72	Avg. 0.70	Avg. 0.70	Avg. 0.72	Avg. 0.71	Avg. 0.70	Avg. 0.70	Avg. 0.68	Avg. 0.70	Avg. 0.71	Avg. 0.70	Avg. 0.71	Avg. 0.70
4 Reps	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2
	Avg. 0.7	Avg. 0.69	Avg. 0.69	Avg. 0.70	Avg. 0.69	Avg. 0.71	Avg. 0.71	Avg. 0.69	Avg. 0.71	Avg. 0.70	Avg. 0.69	Avg. 0.69	Avg. 0.69	Avg. 0.70	Avg. 0.70
75%	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3
	Avg. 0.70	Avg. 0.69	Avg. 0.69	Avg. 0.68	Avg. 0.69	Avg. 0.72	Avg. 0.72	Avg. 0.70	Avg. 0.68	Avg. 0.67	Avg. 0.70	Avg. 0.70	Avg. 0.69	Avg. 0.70	Avg. 0.68
WEEK 6															
3 Sets	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1
	Avg. 0.52	Avg. 0.52	Avg. 0.53	Avg. 0.53	Avg. 0.52	Avg. 0.51	Avg. 0.52	Avg. 0.50	Avg. 0.51	Avg. 0.51	Avg. 0.50	Avg. 0.48	Avg. 0.53	Avg. 0.50	Avg. 0.50
2 Reps	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2
	Avg. 0.5	Avg. 0.51	Avg. 0.51	Avg. 0.52	Avg. 0.51	Avg. 0.49	Avg. 0.50	Avg. 0.50	Avg. 0.50	Avg. 0.50	Avg. 0.51	Avg. 0.50	Avg. 0.52	Avg. 0.51	Avg. 0.51
82.5%	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3
	Avg. 0.51	Avg. 0.51	Avg. 0.51	Avg. 0.50	Avg. 0.50	Avg. 0.50	Avg. 0.51	Avg. 0.49	Avg. 0.49	Avg. 0.50	Avg. 0.50	Avg. 0.49	Avg. 0.50	Avg. 0.50	Avg. 0.49
WEEK 7															
3 Sets	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1
	Avg. 0.69	Avg. 0.69	Avg. 0.70	Avg. 0.68	Avg. 0.67	Avg. 0.70	Avg. 0.68	Avg. 0.68	Avg. 0.68	Avg. 0.66	Avg. 0.68	Avg. 0.65	Avg. 0.67	Avg. 0.68	Avg. 0.67
4 Reps	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2
	Avg. 0.68	Avg. 0.67	Avg. 0.67	Avg. 0.68	Avg. 0.67	Avg. 0.68	Avg. 0.67	Avg. 0.66	Avg. 0.69	Avg. 0.68	Avg. 0.66	Avg. 0.62	Avg. 0.66	Avg. 0.67	Avg. 0.67
77.5%	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3
	Avg. 0.68	Avg. 0.67	Avg. 0.67	Avg. 0.65	Avg. 0.66	Avg. 0.69	Avg. 0.68	Avg. 0.66	Avg. 0.66	Avg. 0.65	Avg. 0.67	Avg. 0.62	Avg. 0.65	Avg. 0.65	Avg. 0.66
WEEK 8															
3 Sets	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1	Set 1
	Avg. 0.47	Avg. 0.48	Avg. 0.46	Avg. 0.45	Avg. 0.46	Avg. 0.48	Avg. 0.47	Avg. 0.46	Avg. 0.48	Avg. 0.49	Avg. 0.48	Avg. 0.46	Avg. 0.49	Avg. 0.47	Avg. 0.48
2 Reps	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2	Set 2
	Avg. 0.46	Avg. 0.45	Avg. 0.45	Avg. 0.43	Avg. 0.46	Avg. 0.46	Avg. 0.45	Avg. 0.44	Avg. 0.46	Avg. 0.47	Avg. 0.48	Avg. 0.46	Avg. 0.47	Avg. 0.48	Avg. 0.48
85%	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3	Set 3
	Avg. 0.46	Avg. 0.43	Avg. 0.45	Avg. 0.43	Avg. 0.43	Avg. 0.46	Avg. 0.43	Avg. 0.44	Avg. 0.44	Avg. 0.47	Avg. 0.46	Avg. 0.44	Avg. 0.46	Avg. 0.47	Avg. 0.46

Table 2: Velocity-Based Dynamic Training Sessions

Velcoity-Based Dynamic Day															
WEEK 1	Pitcher #1	Pitcher #2	Pitcher #3	Pitcher #4	Pitcher #5	Infielder #1	Infielder #2	Infielder #3	Infielder #4	Infielder #5	OutFielder #1	OutFielder #2	OutFielder #3	OutFielder #4	OutFielder #5
8 Sets	Work Avg. Avg. 0.98	Work Avg. Avg. 0.96	Work Avg. Avg. 1.2	Work Avg. Avg. 0.97	Work Avg. Avg. 0.98	Work Avg. Avg. 1.1	Work Avg. Avg. 1.1	Work Avg. Avg. 0.99	Work Avg. Avg. 1.1	Work Avg. Avg. 0.98	Work Avg. Avg. 1.0	Work Avg. Avg. 0.98	Work Avg. Avg. 0.97	Work Avg. Avg. 1.0	Work Avg. Avg. 0.99
2 Reps															
40%															
WEEK 2															
8 Sets	Work Avg. Avg. 1.0	Work Avg. Avg. 0.99	Work Avg. Avg. 1.15	Work Avg. Avg. 1.0	Work Avg. Avg. 1.1	Work Avg. Avg. 1.15	Work Avg. Avg. 1.12	Work Avg. Avg. 1.11	Work Avg. Avg. 1.15	Work Avg. Avg. 1.1	Work Avg. Avg. 1.15	Work Avg. Avg. 1.0	Work Avg. Avg. 1.0	Work Avg. Avg. 1.12	Work Avg. Avg. 1.05
2 Reps															
40%															
WEEK 3															
10 Sets	Work Avg. Avg. 1.0	Work Avg. Avg. 0.99	Work Avg. Avg. 1.15	Work Avg. Avg. 1.0	Work Avg. Avg. 1.1	Work Avg. Avg. 1.15	Work Avg. Avg. 1.12	Work Avg. Avg. 1.11	Work Avg. Avg. 1.15	Work Avg. Avg. 1.1	Work Avg. Avg. 1.15	Work Avg. Avg. 1.0	Work Avg. Avg. 1.0	Work Avg. Avg. 1.12	Work Avg. Avg. 1.05
2 Reps															
40%															
WEEK 4															
8 Sets	Work Avg. Avg. 0.96	Work Avg. Avg. 0.93	Work Avg. Avg. .98	Work Avg. Avg. 0.93	Work Avg. Avg. 0.95	Work Avg. Avg. .98	Work Avg. Avg. .99	Work Avg. Avg. 0.96	Work Avg. Avg. .98	Work Avg. Avg. 0.93	Work Avg. Avg. .99	Work Avg. Avg. 0.94	Work Avg. Avg. 0.92	Work Avg. Avg. .97	Work Avg. Avg. 0.94
2 Reps															
45%															
WEEK 5															
8 Sets	Work Avg. Avg. 0.97	Work Avg. Avg. 0.95	Work Avg. Avg. .99	Work Avg. Avg. 0.94	Work Avg. Avg. 0.97	Work Avg. Avg. 1.0	Work Avg. Avg. 1.0	Work Avg. Avg. 0.98	Work Avg. Avg. .99	Work Avg. Avg. 0.95	Work Avg. Avg. 1.0	Work Avg. Avg. 0.96	Work Avg. Avg. 0.95	Work Avg. Avg. .99	Work Avg. Avg. 0.96
2 Reps															
45%															
WEEK 6															
10 Sets	Work Avg. Avg. 0.97	Work Avg. Avg. 0.95	Work Avg. Avg. .99	Work Avg. Avg. 0.94	Work Avg. Avg. 0.97	Work Avg. Avg. 1.0	Work Avg. Avg. 1.0	Work Avg. Avg. 0.98	Work Avg. Avg. .99	Work Avg. Avg. 0.95	Work Avg. Avg. 1.0	Work Avg. Avg. 0.96	Work Avg. Avg. 0.95	Work Avg. Avg. .99	Work Avg. Avg. 0.96
2 Reps															
45%															
WEEK 7															
8 Sets	Work Avg. Avg. 0.93	Work Avg. Avg. 0.91	Work Avg. Avg. .96	Work Avg. Avg. 0.90	Work Avg. Avg. 0.95	Work Avg. Avg. .96	Work Avg. Avg. .99	Work Avg. Avg. 0.96	Work Avg. Avg. .97	Work Avg. Avg. 0.93	Work Avg. Avg. .98	Work Avg. Avg. 0.94	Work Avg. Avg. 0.92	Work Avg. Avg. .96	Work Avg. Avg. 0.93
2 Reps															
50%															
WEEK 8															
8 Sets	Work Avg. Avg. 0.94	Work Avg. Avg. 0.93	Work Avg. Avg. .98	Work Avg. Avg. 0.92	Work Avg. Avg. 0.97	Work Avg. Avg. .99	Work Avg. Avg. 1.0	Work Avg. Avg. 0.99	Work Avg. Avg. .98	Work Avg. Avg. 0.93	Work Avg. Avg. .99	Work Avg. Avg. 0.93	Work Avg. Avg. 0.91	Work Avg. Avg. .98	Work Avg. Avg. 0.94
2 Reps															
50%															

Table 3: Pre and Post Testing Results

PRE/POST TESTING															
EXERCISES	Pitcher #1	Pitcher #2	Pitcher #3	Pitcher #4	Pitcher #5	Infielder #1	Infielder #2	Infielder #3	Infielder #4	Infielder #5	OutFielder #1	OutFielder #2	OutFielder #3	OutFielder #4	OutFielder #5
Pre-Test 10 yd	1.63	1.6	1.61	1.59	1.56	1.6	1.55	1.54	1.54	1.61	1.56	1.58	1.54	1.59	1.61
Pre-Test Vert	24"	25.5"	29"	27"	30"	28"	26"	25"	25.5"	29.5"	31"	33"	28.5"	30.5"	28.5"
Post-Test 10 yd	1.6	1.58	1.57	1.55	1.54	1.57	1.53	1.52	1.51	1.58	1.54	1.56	1.53	1.55	1.59
Post-Test Vert	27"	28"	30"	28"	31.5"	29.5"	27"	25.5"	27"	31"	32.5"	34"	29.5"	31.5"	30"

CHAPTER FOUR

DISCUSSION

The purpose of the current study was to determine if there will be an increase to power output from the lower extremities of collegiate baseball athletes after velocity-based barbell training. The hypothesis is that velocity-based barbell training will lead to an increase or the ability to maintain the residuals of velocity in the lower extremities for baseball player during the season of play compared to unaccompanied general strength training. Going into the first week of training the athletes already had a great baseline of strength from having years of training in the program that will set them up for success in the program. From the 1st to 8th week of the program the athletes consistently maintained the velocity of the bar within the required range and within the velocity zones that were prescribed by the researcher.

By staying in these zones, the musculature of the body is exposed to different type of velocity, which would be expected to assist in maintaining and improving the velocity residual throughout a time that athletes are not doing speed-specific training. The explanation for this type of training to be effective is that the fast twitch muscle fibers are active and the central nervous system is taxed in a way that allows for this residual to be affected in a positive way. Throughout this training cycle I was interested to see how many of the athletes had to decreased or increase the load in which was used each week. These athletes were able to stay within the range of the velocity zones, there were only three times at the beginning of the training that the weight had to be lowered by 10 pounds in order to allow the athletes to be able to maintain their velocity in the prescribed range. Similarly, there were 10 athletes of the 15 whose loads were increased based on the speeds that they were moving the bar. When the post test was complete I wasn't anticipating that due to the velocity-based barbell training that all the athletes would

increase the residuals of velocity in the lower extremities.

Overall this study suggests that due to velocity-based training the velocity residual was able to improve even though no sprint specific training was utilized during this in-season time of the year. With training in these specific speed zones and continue to push the loads of weight and for strength gains to still be made during a stressful time of the year. With the results come out the way they did, this study was able to find exactly what it was meant to do. As shown in other studies on velocity based training, this type of training has been affective in assisting athlete improve their performance. Stated by Badillo, Blanco, Rosell, Abad-Herencia, Lopez, and Sanchez (2014), velocity based resistance training with moderate load and few repatriations per set seems to be an adequate methodology. This is the rationale used for both training days that will allow for load management and assist in not over working the athletes.

The results from the current study also show support for the benefits of velocity-based training, given that XX participants improved on their vertical leap and 10-yard run. Pitcher 1 vertical went from 24” to 27”, and the 10-yard time went from 1.63 to 1.6. Pitcher 2 vertical went from 25.5” to 28”, and the 10-yard time went from 1.6 to 1.58. Pitcher 3 vertical went from 29” to 30”, and the 10-yard time went from 1.61 to 1.57. Pitcher 4 vertical went from 27” to 28”, and the 10-yard time went from 1.59 to 1.55. Pitcher 5 vertical went from 30” to 31.5”, and the 10-yard time went from 1.56 to 1.54.

Infielder 1 vertical went from 28” to 29.5”, and the 10-yard time went from 1.6 to 1.57. Infielder 2 vertical went from 26” to 27”, and the 10-yard time went from 1.55 to 1.53. Infielder 3 vertical went from 25” to 25.5”, and the 10-yard time went from 1.54 to 1.52. Infielder 4 vertical went from 25.5” to 27”, and the 10-yard time went from 1.54 to 1.51. Infielder 5 vertical went from 29.5” to 31”, and the 10-yard time went from 1.61 to 1.58.

Outfielder 1 vertical went from 31” to 32.5”, and the 10-yard time went from 1.56 to 1.54. Outfielder 2 vertical went from 33” to 34”, and the 10-yard time went from 1.58 to 1.56. Outfielder 3 vertical went from 28.5” to 29.5”, and the 10-yard time went from 1.54 to 1.53. Outfielder 4 vertical went from 30.5” to 31.5”, and the 10-yard time went from 1.59 to 1.55. Outfielder 5 vertical went from 28.5” to 30”, and the 10-yard time went from 1.61 to 1.59.

Regardless of the demands of the sport, these results show support for velocity-based strength training as an effective way to improve power output of athletes in the sport of baseball. Similar concepts were stated by Mann, Ivey, and Sayers (2015) on improving the power production for the athlete to be used within sport. The results from this study provides further support that velocity-based training is beneficial for athletes in power-based sports. Specifically, baseball athletes utilized in this study showed post testing improvements on both their vertical and 10-yard dash times which is consistent with the findings from Mann et al. (2015) that the power production has been improved.

Adding on to what we already know about velocity-based training, the results from this study have provided more support for its use in increasing power production for athletes. From the results of this study, there is a suggestion that proper adjustment on the load of the squat is appropriate for in season training. Although three athletes had to lower the weight on different days, anecdotally, these individuals had unknown stressors affecting their body. This knowledge allows for strength coaches to be in connection with their athletes to make sure that they are training optimally. This situation allowed us to account for the exhaustion levels of the athletes, and provided another method to identify how the athletes were feeling on a given day. As in previous research (Badillo et al., 2014) this seem to be beneficial for their athlete’s success. During this study it also showed to be beneficial, and we believe it had an influence on the

success of the post testing results.

Limitations

An important consideration with the current sample is that the participants were measured during their competitive season. Thus, it is important to take fatigue from play into consideration as a possible confounding variable. Baseball players are allowed to devote 20 hours per week during the season to training, conditioning, and competition, and fatigue may have impacted the outcome of this study. Fatigue levels were suggested as important quality of velocity based training by Jovanovic and Flanagan (2014). This control between each set give us more insight on how the athletes central nervous system is not only reaching to the demands of training, but also what it has gone through during practice and competition. With baseball being such a tax on the central nervous system from the velocities that they throw or swing the bat. This need to be taking into consideration to ovoid overtraining the body during the season. The study by Gurdeep Singh (2016), focused in the fatigue tangible of athletes and the incorporation of velocity based training would assist in keep the athlete neuromuscular strength at its highest capability.

Recommendations

Throughout this study the baseline strength that was already in place for the training cycle started set the athletes up for success. Other studies have used younger athletes and they have seen success, but as far a recommendation from this study I would make sure your athletes have a good base of strength. From this study we were able to support the concept that velocity based training is a successful way to maintain or increase an athlete's velocity residuals based on the improvement of the athletes 10-yard times and their velocity jump performance.

Conclusion

In conclusion, this study allowed for insight on a velocity-based training program and how it impacts the lower extremities power output and velocity residuals with baseball athletes. The impacts on the athlete were positive and allowed for the velocity residuals to increase and assisted the athlete ability to create more power. The velocities that were collected by the Tendo units and GymAware were valid and reliable, making combination of the two allowed for the study to gather a large amount of data in a short amount of time and contributes to our understanding of this type of training as an important component of athletic preparation.

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