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Research Article

Effect of a 12-Week Off-Season Strength Training Program on Athletic Performance in Adolescent Baseball Players

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Abstract

Purpose: Off-season strength training programs have become common place in baseball, as a means to improve athletic performance and reduce injury risk. No study has assessed analytics and advanced metrics during the season following an off-season, baseball-specific strength training program. We hypothesized that players completing a 12-week baseball-specific strength and conditioning program would experience significant gains in running speed and bat exit velocity, as well as in-season hitting performance metrics.

Methods: 25 healthy high school baseball players were recruited into an intervention group. 60-yard dash and batting exit velocity were measured pre-program. The intervention group then performed an off-season 12-week strength training program, with measurements repeated post-program. Hitting performance metrics were assessed in the subsequent baseball season, utilizing a comparison group of teammates who did not perform the program. Changes from baseline were evaluated using paired t-tests within, and the training effect was assessed using repeated-measures analysis of variance to assess differences in changes between the intervention and the control groups. A two-tailed significance level was set at $P< 0.05$.

Results: Running speed showed a statistically significant improvement (0.278 seconds average reduction; 95% CI 0.161, 0.394; $P< 0.001$) while bat exit velocity did not (0.476 mph average gain; 95% CI -1.267, 2.219; $P = 0.575$). There was no statistically significant change in hitting performance among the intervention group in the season following the program when compared to the season immediately preceding the program. No statistically significant changes in hitting performance statistics were observed when comparing intervention players versus the comparison group. No participants were injured at any time during the study.

Conclusion: Performing a 12-week strength training program increased running speed but not bat exit velocity or post-program hitting performance statistics. Baseball-specific strength training programs are safe and effective interventions that can improve athleticism in adolescents.

Keywords: Baseball; Injury risk; Performance; Strength training

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Introduction

Strength, power, speed, and agility are key elements of a baseball player's athletic performance. Like most youth sports, baseball has become a three-season sport, with players often playing 50-60 game summer schedules in addition to their high school seasons as more youth athletes trend towards early specialization [1]. With this early specialization, however, comes an increased risk of overuse injury. Pasulka et al., examined 1,190 youth athletes age 7-18 and found that 26% were single-sport specialized; defined as participating in a single sport for greater than 8 months of the year [1]. Additionally, single-sport athletes were more prone to overuse injury than other athletes, 44.3% versus 32.2% [1]. Equally concerning as the trend in youth sport specialization is the temporal trend of youth muscular fitness (i.e., muscular strength, power and endurance) which indicates that today's youth are weaker and slower than previous generations [2]. Young athletes who do not address neuromuscular deficits and build strength reserves may be more likely to suffer a sports-related injury and less likely to attain elite-level performance [2-4].

One key to combating injury in youth sports could be proper off-season conditioning, both to allow for recovery, promote movement variability and competence, build musculoskeletal capacity and resilience, and to promote muscle memory for future seasons. Off-season strength and conditioning programs have become popular in baseball, as a means to improve athletic performance as well as reduce injury risk. Significant variability exists in baseball-specific training, ranging from resistance training (weightlifting, resistance band and medicine ball workouts, plyometrics) to interval throwing programs to weighted ball throwing [5-7]. Previous studies have demonstrated that lower body power, upper body power, and torso rotational power are correlated to bat swing velocity in adolescent, high school (HS), and college baseball players. Similarly, throwing velocity increases have been demonstrated in HS baseball players that have completed baseball-specific 4-week training programs involving

resistance training [8]. More recently, studies involving weighted ball throwing programs have demonstrated increased pitch velocity following a 6-week program in adolescent pitchers, but at the cost of an increased injury rate (24% injury rate in experimental group vs. 0% in control group) [7]. No current studies have assessed analytic improvements in performance following an off-season, baseball-specific strengthening and conditioning program.

The purpose of our study was to prospectively investigate the effects of 12-week strength and conditioning program on certain sport-specific performance metrics on HS baseball athletes. We hypothesized that athletes participating in strength and conditioning workouts will experience significant improvements in showcase metrics (e.g., 60-yard dash times, batting exit velocity) as well as hitting performance measures in their post-program seasons.

Methods

Subjects

HS baseball players between the ages of 14 and 18 years were recruited for the study during the off-season. Players was excluded if they had a current injury which precluded participation in the program. A total of 25 male baseball players from HS teams within a 50-mile radius of Providence, RI met these criteria and agreed to participate. Each participant completed intake forms consisting of medical history, prior experience with strength and conditioning and baseball background. Participants under 18 years of age provided written assent and their legal guardians provided informed consent. The subjects' mean (standard deviation) age, weight, and height were 15.4 (1.0) years, 73.2 (10.3) kg, and 174.4 (4.2) cm, respectively. Years of baseball experience were 9.7 (1.5).

A comparison group of 15HS baseball players between the ages of 14 and 18 years from one of the local high schools and one of the regional travel teams was created to compare in-season performance metrics. Members of the comparison group were teammates of the participants but did not participate in the program and did not complete pre-/post-program performance measures (e.g., 60-yard dash, batting exit velocity). Participants under 18 years of age provided written assent and their legal guardians provided informed consent. Anthropometric data (weight in kg, height in cm, BMI) were collected prior to program participation utilizing a physician scale (Henry Schein Model 1127157, Melville, NY).

A 12-week strength and conditioning program was developed collaboratively by fellowship-trained sports medicine specialists and certified physical therapists utilizing established strength and conditioning references (Appendix 1) [9-11]. The 12-week duration was determined based on previously published literature regarding off-season strength and conditioning programs in this age group [5,12]. Athletes were to complete workouts twice a week under the direct supervision of certified physical therapists and sports medicine physicians, and once a week on their own. All athletes were given a "workout log" to track their workouts and promote compliance; this notebook included video links to the various exercises so participants could review proper form and technique (Appendix 2).

A showcase-type setting on a HS varsity baseball field (grass surface) was utilized to collect pre-program performance data on September 16, 2018. Post-program data was collected on December 17, 2018 at a university field house which included an indoor batting cage and synthetic surface indoor track. Participants performed a dynamic warm-up prior to data collection. Participants designated their primary and secondary positions, and were grouped according to the following positions: infield, outfield, pitcher, catcher. Average length of time from completion of the program to the beginning of the HS baseball season for most participants was 12 weeks.

Bat Exit Velocity

Participants designated their individual preference of bat material [e.g., wood, metal (alloy, composite)] which was recorded. Participants used the same bat for pre- and post-program data collection. All alloy and composite bats were Bat-Ball Coefficient of Restitution (BBCOR) certified. After performing warm-up swings on a tee, participants faced live pitching in a batting cage from an adult baseball coach who threw fastballs behind an L-screen. Bat exit velocities from 10 swings were recorded using a handheld radar gun (Pocket Radar Model PR1000, Santa Rosa, CA) situated 5 feet behind the hitter outside the cage. The best effort (mph) was utilized.

60-yard dash

Participants performed pre-program 60-yard dashes on the grass in foul territory along the first base side of the field. Distances were measured using an open reel measuring tape. Cones were used to demarcate the start and finish lines. Participants ran the distance one at a time, and times were recorded using a stopwatch, with recordings to the 100th of a second. Hand signals were used to start the heat, and a researcher recorded the participants' times at the finish line. Post-program 60-yard dashes were performed on a synthetic indoor track in a university field house. An identical protocol was used to measure/demarcate distances and times.

In-Season performance metrics

All participants consented to allow researchers to access their 2018 and 2019 GameChanger™ statistics from their HS(varsity, JV) and summer (travel, American Legion) seasons, which were their baseball seasons immediately before and after the strength and conditioning program. GameChanger™ is a free mobile app and website (https://gc.com) that provides scorekeeping, advanced statistics, and live game updates for baseball teams and their fans. For the HSand summer seasons, the participant's primary team's statistical data was used (e.g., varsity OR JV for HS, travel OR American Legion for summer). The comparison group's in-season performance metrics were manually compiled from publicly available box scores available in GameChanger™. Intervention group and comparison group players with at least 20 plate appearances in both 2018 and 2019 with retrievable data in GameChanger™ were included in the analysis.

Statistical analysis

All data were collected and analyzed using SPSS (version 25, IBM Corporation, Armonk, NY) and Stata (version 15.0, StataCorp LLC, College Station, TX).All continuous data were confirmed as adhering to a normal (Gaussian) distribution using the Shapiro-Wilk test and histogram visualization within each group and presented using means and standard deviations. Paired t-tests were performed to evaluate changes from baseline in bat exit velocity, 60-yard dash time and in-season performance metrics. The training effect was assessed using repeated-measures analysis of variance to assess differences in seasonal changes (deltas) between the intervention and the control groups. Changes in continuous outcomes were presented with 95% confidence intervals and P values. A two-tailed significance level was set *a priori* at $P < 0.05$.

Results

A total of 25 HS players participated in the program. Of the 25 participants, 19 players (76%) completed ≥75-90%, 3 players (12%) completed ≥50-74%, and 3 players completed ≥25-49% of the supervised training sessions.20 players completed pre- and post-program 60-yard dashes, and 21 players completed pre- and post-program batting exit velocities. No participants reported any injuries at any time during the study. Pre- and post-program performance measures among the participants are shown in table 1. Running speed showed a statistically significant change (0.278 seconds average reduction; 95% CI 0.161, 0.394; P< 0.001) while bat exit velocity did not (0.476 mph average gain; 95% CI -1.267, 2.219; P = 0.575).

Performance Measure	N	Pre	Post	Change	95% CI for Change	P value
60-yard dash (sec)	20	8.085 ± 0.648	7.807 ± 0.548	0.278	(0.161, 0.394)	0.0001
Batting Exit Velocity (mph)	21	74.71 ± 5.875	75.19 ± 6.431	0.476	(-2.219, 1.267)	0.575

Table 1: Pre- and Post-Program Performance Measures among Players with Intervention.

Data are presented using mean ± standard deviation for each performance measure.

The evaluation of the change in performance measures from pre- to post-program was done using paired t-tests.

Evaluation of change in hitting performance from 2018 and 2019 seasons among players in the intervention group is shown in table 2. Of the 25 participants, 18 players had at least 20 plate appearances in each season with retrievable data in Game Changer™, which were criteria for inclusion in the analysis. Batting average (BA), on base percentage (OBP), slugging percentage (SLG), and on base plus slugging percentage (OPS) performance statistics were calculated using standard formulas (www.baseball-reference.com). No statistically significant change in hitting metrics was observed for the intervention group in the season following the strength training program compared to the season prior to the program.

Hitting Metric	2018 Season (n=18)	2019 Season (n=18)	Change	95% CI for Change	P value
BA	0.286 ± 0.018	0.298 ± 0.066	0.012	(-0.027, 0.050)	0.547
OBP	0.412 ± 0.066	0.401 ± 0.069	-0.011	(-0.053, 0.030)	0.568
SLG	0.376 ± 0.109	0.388 ± 0.121	0.012	(-0.043, 0.069)	0.63
OPS	0.762 ± 0.204	0.789 ± 0.168	0.027	(-0.086, 0.141)	0.619

Table 2: Evaluation of Change in Hitting Performance from 2018 to 2019 among Players with Intervention.

Players with at least 20 plate appearances in both 2018 and 2019 were included in the analysis.

Data are presented using mean ± standard deviation for each year. The evaluation of the change from 2018 to 2019 was done using paired t-tests.

Hitting performance statistics from 2018 and 2019 seasons were also analyzed among players in the comparison group (Table 3). Of the 15 players in the comparison group, 11 players had at least 20 plate appearances in each season with retrievable data in Game Changer™. No statistically significant changes in hitting metrics were observed for the comparison group in the season following the strength training program compared to the season prior to the program.

Hitting performance metrics were evaluated between the intervention group and the comparison group (Table 4). No statistically significant changes in BA, OBP, SLG, or OPS were observed between these groups in the season prior to and following the strength training program. Figure 1 summarizes the hitting performance metrics of the intervention and comparison groups in seasons 2018 and 2019.

Hitting Metric	2018 Season (n=11)	2019 Season (n=11)	Change	95% CI for Change	P value
BA	0.240 ± 0.084	0.264 ± 0.119	0.024	(-0.074, 0.122)	0.598
OBP	0.361 ± 0.100	0.348 ± 0.122	-0.013	(-0.125, 0.100)	0.814
SLG	0.286 ± 0.111	0.303 ± 0.141	0.017	(-0.106, 0.141)	0.759
OPS	0.647 ± 0.204	0.647 ± 0.246	0	(-0.234, 0.234)	0.997

Table 3: Evaluation in Change in Hitting Performance from 2018 to 2019 among Comparison Group.

Players with at least 20 plate appearances in both 2018 and 2019 were included in the analysis.

Data are presented using mean ± standard deviation for each year. The evaluation of the change from 2018 to 2019 was done using paired t-tests.

Discussion

A 12-week off-season strength training program for HS baseball players safely and effectively enhanced physical performance with regards to 60-yard dash times. Also, while a statistically significant increase in bat exit velocity was not found, our study did show an increase in bat exit velocity of nearly half a mile per hour. This slight increase could be the difference between a hard-hit single up the middle and a diving defensive play by a middle infielder resulting in a routine out at first. No injuries were documented during the training process, and no injuries which could be attributed to the training program occurred in the subsequent baseball season. This is important in validating the safety and effectiveness of such a program in order to best develop youth athletes, both with regards to physical performance as well as injury prevention. As single-sport specialization becomes more common among youth athletes, strength training programs that emphasize sport-specific training while allowing adequate recovery from the prior season will be essential. Moreover, our results support the previous claims made by Faigenbaum et al., [2] that

Hitting Metric	Change among Intervention Players (n=18)	Change among Comparison Group (n=11)	P value
BA	0.012 ± 0.077	0.024 ± 0.146	0.761
OBP	-0.011 ± 0.084	-0.013 ± 0.167	0.988
SLG	0.012 ± 0.112	0.017 ± 0.184	0.934
OPS	0.027 ± 0.228	0 ± 0.349	0.797

Table 3: Comparison of Change in Hitting Performance from 2018 to 2019 between Intervention Players vs Comparison Group.

Players with at least 20 plate appearances in both 2018 and 2019 were included in the analysis.

Data are presented using mean ± standard deviation for each year. The evaluation of the change from 2018 to 2019 was done using paired t-tests.

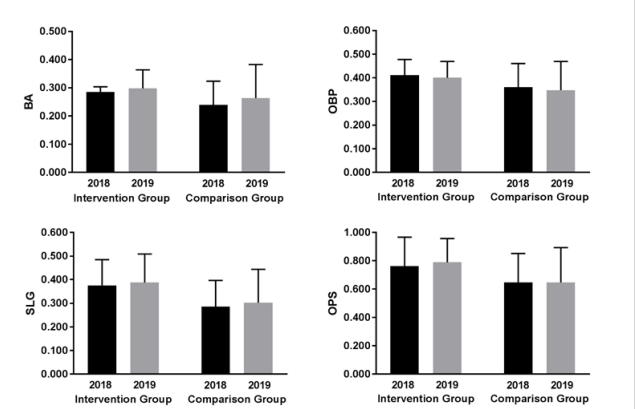

Figure 1: Hitting performance metrics of the intervention and comparison groups in seasons 2018 and 2019.

regular participation in a well-designed youth resistance training program can alter physical activity trajectories, increase muscular fitness, enhance performance and reduce associated injury risks in children and adolescents.

To our knowledge, our study is the first to investigate the effect of an off-season strength training program on performance metrics for athletes using publicly available data, comparing the season immediately prior to the season following the training program, in any organized sport. There are however some studies that examine the short term ability of strength and conditioning programs with regards to maximum velocity [8,13]. Escamilla et al., showed an increase in maximum pitching velocity in 11-15 year old athletes following a 4-week organized conditioning program [8]. The authors noted that this was a short term increase and an association with in-season performance was not investigated. Escamilla et al., performed a similar study in a group of 14-17 year old athletes, which is more consistent with the current study [13]. Three separate 6-week throwing programs, Throwers Ten (TT), Keiser Pneumatic (KP), and Plyometric (PLY), all resulted in a significant increase in throwing velocity compared to the control group [13]. Once again the authors did not examine the effect of the program on injury rates or in-season performance.

With regard to performance, our current study did not demonstrate statistically significant improvement in any of the major offensive statistical categories (BA, OBP, SLG, OPS) for the intervention group versus the comparison group. This could have been due to limitations in sample size in both the study and comparison groups. Additionally, as demonstrated by the aforementioned Escamilla study, 6 physical gains in strength training programs may potentially be short-term and transient in nature. It is possible that athletes whom perform pre-/off-season strength training programs achieve their peak level of fitness early in the season, as athletic (e.g., games, practices, travel, suboptimal meal schedules), academic (e.g., homework, exams, standardized testing, tutoring), and social (e.g., video games, dating) scheduling during the season interferes with ideal strength and conditioning programming and nutrition/hydration. Consequently, sustaining off-season strength training gains in-season can be very challenging to attain, and inevitably requires an in-season strength training program with modified volume/intensity that can be practical to perform [14,15].

Our study had several limitations. First, participants were not randomized into intervention and control groups. Second, sample size (participant, comparison groups) was limited, and, for this reason, participant and comparison groups were not equal. Additionally, it was our intent to stratify the participant group by the percentage of supervised training sessions they attended (e.g., ≥75-90%, ≥50-74%, ≥25-49%, < 25%) and compare performance metrics among the four groups. However, a small sample size prevented stratified analysis. Fourth, due to winter weather conditions in the Northeast, we were unable to perform pre- and post-program 60-yard dash testing and bat exit velocity testing in the same environments. It is possible that the improved mean 60-yard dash times achieved on an indoor synthetic surface could be partially due to differing extrinsic factors. Brechue et al., [16] evaluated 68 National Collegiate Athletic Association (NCAA) Division II college football players to determine the effects of football equipment and running surface on the 40-yard dash times. Running surfaces used included a rubberized indoor track in the field house, and outdoor natural grass game field at the football stadium. Sprint performance was significantly impaired when running on natural grass compared with running on an indoor rubberized track (linemen: 0.15 ± 0.09-second increase on grass vs. indoor surface; backs: 0.12 ± 0.06-second increase), and the magnitude of the sprint performance impairment was similar between linemen and backs.

While it is likely that the improved sprint performance result in our study was a direct result of surface type, the mean decrease in sprint performance time was 0.278 seconds, the magnitude of change which unlikely can be explained by running surface alone. Even a 0.100 second improvement in 60-yard dash time in baseball is clinically significant, and can mean the difference between an infield single versus an out, or a stolen base versus caught stealing. Also, with regards to performance and injury we did not perform a longitudinal analysis of performance or injury rate in the study group. As we only have one year's worth of data, it may be truly difficult to determine the cumulative effect that the strength and conditioning program had on performance and injury prevention; this could be improved with further follow up. Additionally, because the training program was completed by December, it is possible that any gains imparted by the program may have been lost by the time the spring season began in March. Finally as with any study of adolescent athletes, it was not possible to determine if physical gains were solely a result of their growth and maturation as the transition to skeletally mature athletes.

Conclusion

Performing a 12-week strength training program significantly increased running speed but not bat exit velocity or post-program hitting

performance statistics. Baseball-specific strength training programs are safe and effective interventions that can improve athleticism in adolescents, and likely result in clinically significant gains in both sprint performance and bat exit velocity. Future research utilizing prospective, randomized controlled trials assessing the effect of combined off-season and in-season strength training programs on baseball-specific metrics (e.g., showcase metrics and in-season advanced metrics for hitting) and injury can provide essential data targeting injury prevention in a single-sport specialization era.

Conflict of Interest

The authors have no relevant financial disclosures or conflicts to report. No external funding was received for this project.

Appendix 1: Strength and Conditioning Program

University Orthopedics Baseball Off-Season Training Program 2018-19							
Phase 1 Weeks 1-4							
Dynamic Warmup (10 min, Days 1-3)	**Reps**						
Kneeling couch stretch	3/side						
Kneeling split stance hip adductor stretch	3/side						
Bear crawls	8/side						
1 leg SLDL walk	5/side						
Lunge walk with 3 ptext, thoracic rotation	6/side						
Prayer lats stretch w/ exhale	5x						
Forearm Wall slides "Y's"	1x8						
Training (Day 1)	**Sets**	**Reps**	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**
A1) Medicine Ball Overhead Slam	4	10					
B1) Kettlebell Deadlift	5	5					
B2) Single Arm Cable Row	3	8					
C1) Single Leg Hip Thrust from Box	5	5					
C2) Quadruped T and Y	4	6					
D1) Band Assisted Pull Up	5	4					
D2) Anti Rotation Press	3	8					
Training (Day 2)	**Sets**	**Reps**	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**
A) Box Jump	5	3					
B1) Goblet Squat	5	5					
B2) Core Activated Dead Bug	3	8					
C1) Push Up, Yoga Variation	5	5					
C2) Band Pull Apart Series	3	8/ each					
D1) Split Squat	5	5					
D2) Suit Case Carries	5	Laps					
ESD Sled Push	5	Laps					
Training (Day 3)	**Sets**	**Reps**	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**
A) 25 yard sprint	10	1					
B1) Cable Pull Through	5	5					
B2) Bear Plank with Shoulder Tap	3	5					
C1) Goblet Loaded Lateral Lunge	5	5					
C2) Alternating Dumb Bell Floor Press	3	8/ each					
D1) SL RDL	5	5					
D2) Contralaterally loaded Step Up	3	10					

University Orthopedics Baseball Off-Season Training Program 2018-19							
Phase 2 Week 5-8							
Dynamic Warm-up (10 min, Days 1-3)	**Reps**						
Kneeling couch stretch	3/side						
Kneeling split stance hip adductor stretch	3/side						
Bear crawls	8/side						
1 leg SLDL walk	5/side						
Lunge walk with 3 ptext, thoracic rotation	6/side						
Prayer lats stretch w/ exhale	5x						
Forearm Wall slides "Y's"	1x8						
Training (Day 1)	**Sets**	**Reps**	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**
A1) Med Ball Kneeling Chest Pass/Hip Hinge	5	6					
B1) Trap Bar Deadlift	5	5					
B2) Bottoms Up KB Press	3	8					
C1) Pull Up	5	4					
C2) Side Plank with Row	4	5					
D1) SL RDL with Cable	5	5					
ESD Battle Ropes Circuit	5	30 sec					
Training (Day 2)	**Sets**	**Reps**	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**
A) Kettlebell Swing	5	10					
B1) Bilateral Kettlebell Racked Squat	5	5					
B2) Stir the Pot	3	8					
C1) Landmine Press	5	5					
C2) Band Step Back @ 90/90	3	8/ each					
D1) Rear Foot Elevated Split Squat	5	5					

D2) Half Kneeling Cable Chop	3	8					
ESD Lateral Sled Drag	5	Laps					
Training (Day 3)	**Sets**	**Reps**	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**
A1) Bench Straddle Hop	3	8					
B1) Cable Alternating Row	5	5					
B2) Hamstring Curl with Ball	3	8					
C1) Inverted Row	5	5					
C2) Bench Side Plank	4	4					
D1) Leg Press	6	5					
ESD Bike Interval Circuit		30 sec sprint, 2 min cruise					

University Orthopedics Baseball Off-Season Training Program 2018-19							
Phase 3 Week 9-12							
Dynamic Warm-up (10 min, Days 1-3)	**Reps**						
Kneeling couch stretch	3/side						
Kneeling split stance hip adductor stretch	3/side						
Bear crawls	8/side						
1 leg SLDL walk	5/side						
Lunge walk with 3 point ext, thoracic rotation	6/side						
Prayer lats stretch w/ exhale	5x						
Forearm Wall slides "Y's"	1x8						
Training (Day 1)	**Sets**	**Reps**	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**
A1) Medicine Ball Crow Hop to Shot Put	4	5					
B1) Landmine SL RDL	5	5					
B2) Suspension Trainer Fall Out	4	5					
C1) Step Up	5	5					
C2) Cable Row to 90/90 ER	4	5					
D1) Single Arm Cable Pull Down	3	8					
D2) Split Stance Chop	3	8					
ESD Speed Ladder Frontal Plane Emphasis	5	laps					
A) Kettlebell Swing	5	10					
Training (Day 2)	**Sets**	**Reps**	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**
A) Medicine Ball Side Throw	5	8					
B1) Reverse Lunge	5	5					
B2) Side Plank with Clam	3	8					
C1) Turkish Get Up	5	2					
C2) X Band Walk	3	8/ each					
D1) Suspension Trainer Assist Bowler Squat	5	5					
D2) Landmine Row	5	5					
ESD Speed Ladder with Sag Plane Emphasis	5	Laps					
Training (Day 3)	**Sets**	**Reps**	**Set 1**	**Set 2**	**Set 3**	**Set 4**	**Set 5**
A) Heiden	5	8					
B1) Rack Pull	5	5					
B2) Tall Kneeling Band Alphabet	2	1					
C1) Renegade Row	5	5					
C2) Split Squat with Anti Rotation Press	3	8/ each					
D1) Dumb Bell Incline Press	5	5					
D2) Lateral Step Up	3	10					

Appendix 2: Video Links for Exercises

Exercise	Type phrase below in YouTube Search box. Video should be top video in list!
Phase 1	
Dynamic Warm-up	
Kneeling rectus femoris stretch/couch stretch	UOI couch stretch
Kneeling split stance hip adductor stretch	UOI kneeling hip adductor stretch
Bear crawls	UOI bear crawl
1 leg SLDL walk	UOI SLDL walk
Lunge walk, 3 pt extension, thoracic rotation	UOI lunge 3 ptext
Prayer lats stretch w/exhale	UOI prayer lats stretch
Forearm Wall Slides "Y's"	UOI wall slide 1, UOI wall slide 2
Training (Day 1)	
Medicine Ball Overhead Slam	UOI med ball overhead slam
Kettlebell Deadlift	Great kettlebell exercise for legs and back
Single Arm Cable Row	Cressey standing 1-arm cable row
Single Leg Hip Thrust from Box	Resilient bench supported single leg
Quadruped T and Y	Haverford quadruped Y and T (**2nd video from top**)
Band Assisted Pull Up	Crossfit band assisted pull-up
Anti Rotation Press	Doherty cable anti-rotation press
Training (Day 2)	
Box Jump	Herman box jump
Goblet Squat	Herman goblet squat
Core Activated Dead Bug	Robertson core engaged dead bugs
Push Up, Yoga Variation	Cressey arm care lesson 4

Band Pull Apart Series	Cressey band pullapart
Split Squat	Herman split squat
Suit Case Carries	Testosterone kettlebell suitcase
Sled Push	Mind pump sled push
Training (Day 3)	
25-yard sprint	25 yard sprint buildup
Cable Pull Through	Martinez cable pull throughs
Bear Plank with Shoulder Tap	Fisher quadruped plank bear
Goblet Loaded Lateral Lunge	Cressey dumbbell goblet
Alternating Dumbbell Floor Press	Herman dumbbell floor
Single Leg RDL	Testosterone single leg Romanian
Contralaterally loaded Step Up	Cutler contralateral step up

Video Links for Exercises

Exercise	Type phrase below in YouTube Search box. Video should be top video in list!
Phase 2	
Dynamic Warmup	
Kneeling rectus femoris stretch/couch stretch	UOI couch stretch
Kneeling split stance hip adductor stretch	UOI kneeling hip adductor stretch
Bear crawls	UOI bear crawl
1 leg SLDL walk	UOI SLDL walk
Lunge walk, 3 pt extension, thoracic rotation	UOI lunge 3 ptext
Prayer lats stretch w/exhale	UOI prayer lats stretch
Forearm Wall Slides "Y's"	UOI wall slide 1, UOI wall slide 2
Training (Day 1)	
Medicine Ball Kneeling Chest Pass/Hip Hinge	MB chest pass tall kneel w hinge
Trap Bar Deadlift	How to Beast trap bar deadlift
Bottoms Up Kettlebell Press	Cressey bottoms up KB military
Pull Up	Herman pull up 3 golden rules
Side Plank with Row	Momentum side plank cable row
Single Leg RDL with Cable	Bodysmith low cable single
ESD Battle Ropes Circuit	Criticalbench battle ropes circuit
Training (Day 2)	
Kettlebell Swing	Men's Health kettlebell swing
Bilateral Kettlebell Racked Squat	Filly dual KB rack squat
Stir the Pot	Testosterone stir the pot
Landmine Press	Cressey landmine press
Band Step Back @ 90/90	(no video available)
Rear Foot Elevated Split Squat	Resilient RFESS
Half Kneeling Cable Chop	Cressey half kneeling cable chop(2ndfr top)
Lateral Sled Drag	Resilient lateral sled drag
Training (Day 3)	
Bench Straddle Hop	Resilient bench straddle hop
Cable Alternating Row	Tier 1 single arm alternating
Hamstring Curl with Ball	Beier swiss ball hamstring
Inverted Row	Cressey pronated grip
Bench Side Plank	Resilient bench side plank (**2nd fr top**)
Leg Press	Instructional fitness seated leg press
ESD Bike Interval Circuit	Body Coach HIIT exercise bike

Video Links for Exercises

Exercise	Type phrase below in YouTube Search box. Video should be top video in list!
Phase 3	
Dynamic Warmup	
Kneeling rectus femoris stretch/couch stretch	UOI couch stretch
Kneeling split stance hip adductor stretch	UOI kneeling hip adductor stretch
Bear crawls	UOI bear crawl
1 leg SLDL walk	UOI SLDL walk
Lunge walk, 3 pt extension, thoracic rotation	UOI lunge 3 ptext
Prayer lats stretch w/exhale	UOI prayer lats stretch
Forearm Wall Slides "Y's"	UOI wall slide 1, UOI wall slide 2
Training (Day 1)	
Medicine Ball Crow Hop to Shot Put	Warbird medicine ball crowhop
Landmine Single Leg RDL	Filly Landmine Single Leg
Suspension Trainer Fall Out	Unified suspension trainer
Step Up	Men's Health stepup(**2nd from top**)
Cable Row to 90/90 ER	**(no video available)**
Single Arm Cable Pull Down	Cressey half-kneeling 1-arm lat
Split Stance Chop	HighPerformance split stance high to low
ESD Speed Ladder Frontal Plane Emphasis	Forefront frontal plane agility
Training (Day 2)	
Medicine Ball Side Throw	Cressey rotational medicine ball shotput
Reverse Lunge	Resilient reverse lunge
Side Plank with Clam	Reinold side plank clam exercise
Turkish Get Up	Kettlebell kings turkish get up
X Band Walk	Coach Will X band walk
Suspension Trainer Assisted Bowler Squat	Rippel suspension trainer bowler
Landmine Row	Herman how to t bar row (**2nd from top**)
ESD Speed Ladder with Sagittal Plane Emphasis	Forefront sagittal plane agility
Training (Day 3)	
Heiden	High Performance Heidens (**2nd from top**)
Rack Pull	Herman rack pull
Tall Kneeling Band Alphabet	Gibbons tall kneeling paloff
Renegade Row	Strength camp renegade row
Split Squat with Anti Rotation Press	Split Squat Pos Anti-Rotational Press
Dumbbell Incline Press	Herman dumbbell incline press
Lateral Step Up	Petersen goblet lateral step up

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