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Offseason Workout Recommendations for Baseball Players

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Abstract

Purpose of Review Offseason training programs are crucial for the baseball athlete. Preparation for the competitive season should be carefully planned to allow long-term athletic success. The two goals of the offseason training program are to optimize performance and reduce injury risk. These goals can only be accomplished with an understanding of the unique physical demands of the sport, and how these demands relate to performance and injury. The purpose of this article is to review the unique demands of baseball training along with current strength and conditioning principles to optimize offseason training for the baseball athlete.

Recent Findings Traditional strength and conditioning programs used in other sports may not maximize the qualities necessary for optimal baseball performance. Traditional strength and conditioning exercises, such as squat and deadlift, primarily train sagittal plane movement while frontal and transverse plane movements are likely equally as important for baseball players. Biomechanical studies have shown that trunk rotation power has the largest influence on throwing velocity in pitchers. Programs should also be designed to reduce injury risk for common injuries. The most common injuries in baseball include hamstring strains, throwing arm injuries, paralumbar muscle strains, hip adductor strains, and oblique muscle strains.

Summary This review describes the typical periodization phases of the offseason and provides a sample program outlining an offseason program for a professional baseball player from September through February.

Keywords Baseball · Offseason · Strength and conditioning

Introduction

Baseball strength and conditioning has evolved dramatically in the last 40 years. Historically, coaches and players believed becoming too muscular would impair performance. Spring training games were believed to be sufficient conditioning for players to prepare for the regular season.

Now, a large focus is placed on offseason programs to enhance performance. Spring training is viewed as a continuation of training in preparation for the regular season, not as the sole preparation period (Fig. 1). In-season and off-season strength and conditioning programs are both valuable components of a complete baseball training program when designed appropriately [1, 2].

As our understanding of the physiological factors that relate to baseball performance continues to evolve, there is a greater need for baseball-specific strength and conditioning programs. Traditional programs designed to enhance performance in other sports, such as football and track and field, may not maximize the necessary qualities needed in a rotational sport. In order to design the most effective program to enhance performance in baseball players, strength coaches should understand the unique needs of the sport.

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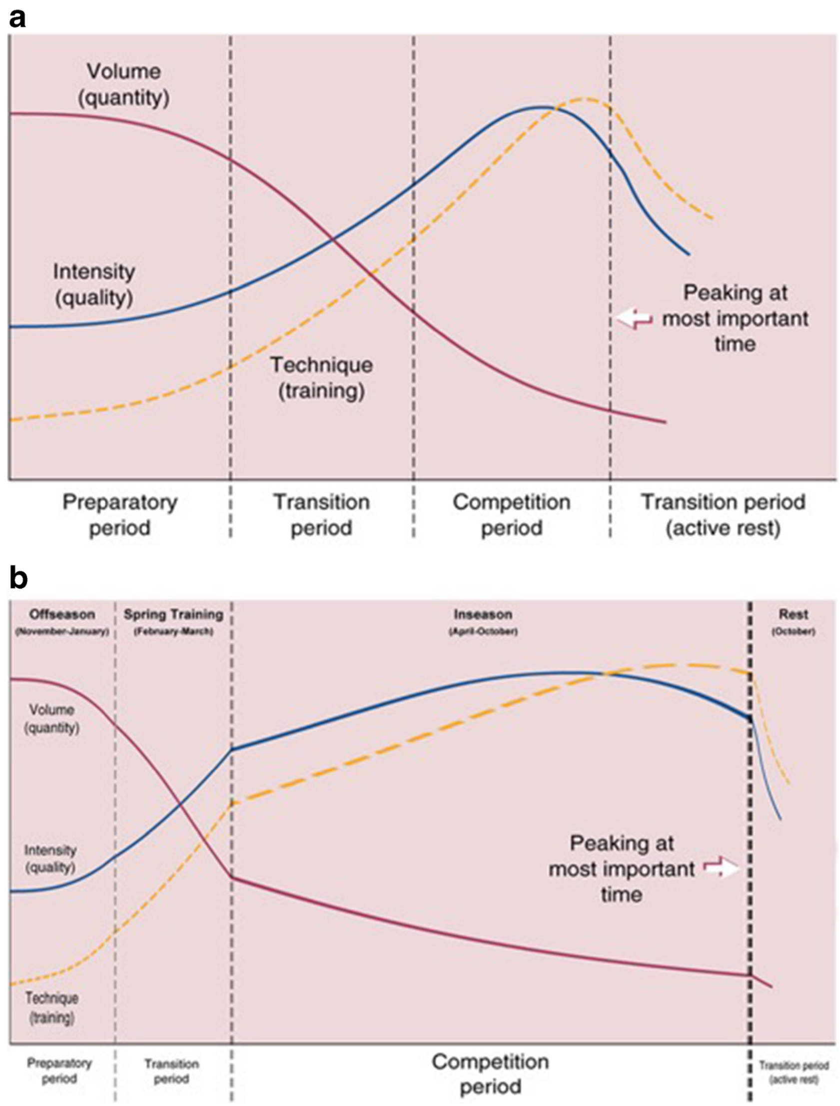

Fig. 1 **a** A normal periodization plan has a smooth transition from a higher volume and lower intensity preparatory period to a lower volume and higher intensity competition period. The end of the competition period culminates with a focus on sport-specific technique training to allow peak performance in competition. **b** The long competitive season of professional baseball requires a more abrupt transition from the off-season preparatory period to the competition period

Off-season Baseball Strength and Conditioning Objectives

The primary objectives of the baseball off-season strength and conditioning program are injury prevention and performance enhancement.

To develop a proper strength and conditioning program specific to baseball players, one must understand the unique needs and demands of the sport. First, common injuries should be identified based on the sport and specific player's position. Then, interventions can be prescribed to reduce injury risk. The most common injuries in baseball include hamstring strains, throwing arm injuries, paralumbar muscle strains, hip adductor strains, and oblique muscle strains. Programs should be designed with these injuries in mind.

Emphasis should be placed on improving mobility, increasing strength, and appropriate workload progressions for baseball-specific activities, such as sprinting, hitting, and throwing. Lack of adequate training in the off-season may be reflected by injury rates in the early months of the Major League Baseball (MLB) season as acute workload quickly increases [3]. For example, hamstring injuries are the most common injury in professional baseball, and the rate of hamstring injury is higher in April and May than any remaining months of the MLB regular season [4••, 5]. Proper programming should be designed to progressively build the athlete's workload to prepare for in-season demands and minimize sharp increases in workload.

In addition to understanding the unique demands of the sport that may help reduce injury rates, it is also important to understand the physical characteristics that relate to enhanced performance. Qualities associated with baseball performance include body mass, strength, running speed, linear and rotational power, throwing velocity, and bat velocity [6–9]. Examination of publicly available MLB databases reveals that the height and weight of the average MLB player have increased over the past 40 years, and the top offensive performers in the MLB are consistently taller and heavier than MLB average [6]. Hoffman et al. [7] compared players across a single professional baseball organization and found similar trends. MLB players have greater body mass than players at lower level minor league affiliate teams. They also found that MLB players have greater grip strength, faster 10-yard sprint times, and greater peak and mean vertical jump power when compared to minor league players. A comprehensive off-season baseball strength and conditioning program is critical to develop these qualities for in-season performance.

Unique Training Demands of Baseball

While baseball training shares similar principles with other sports, coaches should be mindful of the unique demands of baseball-specific movements, especially pitching and hitting. Traditional strength and conditioning exercises, such as squat and deadlift, primarily train sagittal plane movement while frontal and transverse plane movements are likely equally as important for baseball players. Additional focus on developing strength and power outside of the sagittal plane should be included.

Lehman et al. [8] compared multiple field tests to throwing velocity, including medicine ball squat throw, medicine ball scoop toss, vertical jump, broad jump, and sprint speed tests. The only field tests that correlated with throwing velocity were lateral to medial jump and medicine ball scoop toss. Furthermore, a segmental power analysis on baseball pitching determined that trunk rotation power had the largest influence on throwing velocity in high school and professional pitchers [10•]. Therefore, a proper baseball-specific training program should focus on developing linear land rotational power (Figs. 2 and 3).

When designing baseball-specific strength and conditioning programs, it is also important to determine which traditional exercises may not be advantageous to this population. Olympic weightlifting movements are commonly prescribed in other sports to develop power. While these exercises are effective at developing power, they require significant instruction and learning time to be performed safely [11], and may place the throwing arm in disadvantageous positions. Plyometric training can likely achieve similar training effects without the technical demands of weightlifting [12]. The catch position of weightlifting movements can be especially concerning for baseball athletes given the high proportion of shoulder and elbow injuries in weightlifting and baseball [4••, 13]. The catch position of the snatch requires significant shoulder flexion range of motion (ROM), but many baseball players are lacking full shoulder flexion [14]. Strength and conditioning programs should be mindful of ROM limitations when programming any overhead exercises for the baseball athlete. The catch phase of the clean is also concerning for baseball athletes because of the valgus stress that may be experienced at the elbow. The front rack position mimics positions for provocative testing of the ulnar collateral ligament and ulnar nerve of the elbow [15]. Traditional strength and conditioning exercises should be carefully considered when programming for the unique physical demands and adaptations of the baseball athlete.

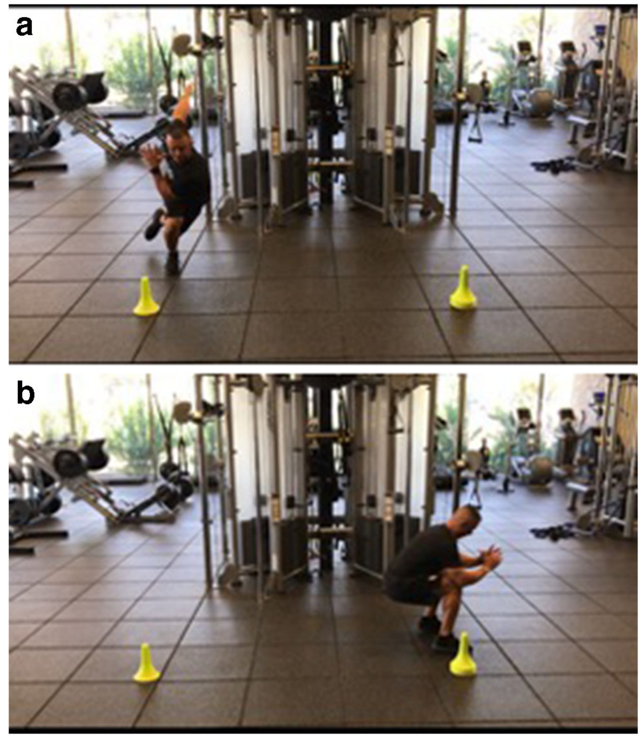

Fig. 2 Demonstration of linear power exercises from start (**a**) to finish (**b**) position

Principles of Strength and Conditioning in Baseball Players

The baseball-specific performance enhancement and injury prevention process is directed by a data-driven approach to assess and expose an athlete's biomechanical needs, as they relate to asymmetry and joint mechanics [16], which leads to the development of a customized program.

Along with the goals of each athlete, the kinematic and kinetic variables that influence the dynamic athletic qualities of each position are used to determine the most optimal evidence-based methods. These variables include the attributes that ensure optimal lumbopelvic control and mobility throughout functional movements [17], developing force and velocity to improve an athlete's ballistic push-off performance during linear and rotational movements [18], the ability to transfer force from proximal to distal throughout the kinetic

Fig. 3 Demonstration of rotational power exercise from start (**a**) to finish (**b**) position

chain [19], and the implementation and manipulation of each training variable through periodization schemes.

Programming should also consider the injury risk factors associated with each position as pitchers exhibit shoulder and elbow injuries while position players are susceptible to hamstring injuries [5, 20] .

Functional Assessments

The first step in designing an effective off-season baseball strength and conditioning program is performing functional assessments. Various vertical (e.g., countermovement jumps, drop jumps) and linear jumps (e.g., single leg jump) tasks may be used to assess the performance capacities that relate to strength and power while also identifying an athlete's ability to utilize the stretch-shortening cycle [21]. Lower body power is the predominant performance variable that is correlated with pitching velocity [19]. Sprinting ability is correlated with linear jumping performance, while bat speed is correlated with lower extremity power and grip strength [22–24]. Meanwhile, the reactive strength index can assess an athlete's explosive power [25].

As an athlete's maximal strength may increase rapidly along with considerations to fluctuating daily fatigue levels, ongoing strength assessments may be necessary for appropriately developing training intensities that help promote the adaptation response while limiting recovery time [26]. The inverse linear relationship between load and velocity allows the ability to predict maximal values from submaximal loads using devices, such as linear position transducers or wearable inertial sensors, that avoid traditional modes of 1RM predictions that are influenced by fatigue and may include injury risk [26, 27]. Furthermore, load-velocity profiles may be created from relative loads between 20 and 90% of 1RM to prescribe mean propulsive and mean velocities [26].

The implementation of speed and agility assessments is necessary to help ensure that the transfer of training is contributing to the improvements in these performance variables. The pro agility assessment helps determine the characteristics involved with an athlete's change of direction (COD) ability [28, 29]. Because linear sprinting plays a crucial role on the field, the 10-yard dash test identifies an athlete's acceleration ability [30, 31].

Optimize Mobility

Players typically lose ROM over the course of the season due to the demands of the long season. Restoring both active and passive ROM after the daily physical requirements will help promote efficient athletic movements on the field while also facilitating resistance training adaptations. Common methods to maximize mobility of the upper extremity include strap/band-resisted techniques to aid optimal thoracic function (Fig. 4). Self-myofascial release (SMR) techniques that include foam rolling along the hamstrings, for example, and rolling over the plantar surface of the foot with a lacrosse ball may improve tightness developed during the season [32]. When applied to the triceps surae, hamstrings, and the quadriceps, SMR increases blood flow and muscle tissue temperature, which reduces muscle restrictions and improves ROM [33]. Joint distraction techniques using elastic bands are another method to improve lower extremity mobility [34]. Neural flossing or neurodynamic sliding is a technique that

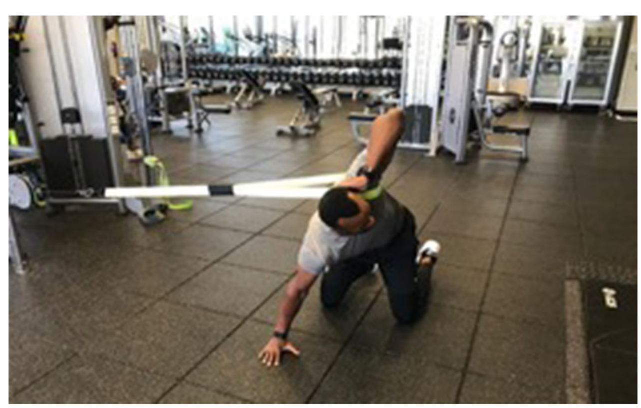

Fig. 4 3D strap quadruped thoracic spine mobility

has also been shown to improve hamstring ROM integrating the musculoskeletal and nervous systems through gliding movements or "sliders" between non-neural tissues and neural structures [35, 36].

Develop Strength

Resistance training protocols include a specialized outline that incorporates training modalities along the force-velocity curve designed to enhance performance. A large focus is placed on lower body strength development since the majority of baseball movements are generated from the ground up and used to initiate kinematic sequences. Periods of super-compensation from training and regeneration properties help lead to optimal metabolic and neurophysiological adaptations [37]. Eccentric-overload resistance, such as the Nordic hamstring exercise, is an effective means of promoting muscle damage prevention mechanisms including higher motor unit activation and enhanced performance [38–40]. Considering the minimal amount of time needed to execute pitching and batting movements, emphasizing explosive strength and the rate of force production (RFD) is necessary for effective transfer of training [41].

Planned periodization schemes include systematic variations of training specificity, intensity, and volume, which are structured within a year-round plan (macrocycle-year-long) and are broken into smaller time increments (mesocycle-weeks to months and microcycle phases within each subdivision) with manipulations made according to the athletes' physiological response and their developmental stages [38•, 42–44]. As athletes progress through each periodization phase, it is important to consider the volume that coincides with optimal strength gains and exceeded volumes that may lead to a point of diminished gains while becoming a detriment to performance [38•].

Commonly used periodization models include linear (LP) and undulating periodization (UP). LP involves the typical breakdown of macrocycles into mesocycles and microcycles as volume and intensity are progressed inversely over time while UP focuses on more frequent, daily, weekly, or biweekly intensity and volume variations that rely on repetition maximum zones [45]. However, there have been no significant differences in upper or lower extremity strength improvements between LP and UP. An athlete's training history along with the variety of training influences should be considered for further stimulation of strength development [45].

Maximize Power

Power development is intended to increase rate of force development (RFD) by taking into consideration the velocity component of the power equation (power = force × velocity) essential for linear and rotational movements. The mechanisms that are utilized to enhance RFD and promote throwing and bat swing velocity include increasing the number of motor units activated, synchrony efficiency, and the velocity of execution [46]. Velocity-based training (VBT) may be utilized to help monitor the velocity of exercise. Incorporating velocity loss training zones aiming to promote maximal force, power output, and mean and peak velocities may help avoid mechanical stress and time under tension with unnecessary repetitions resulting from concentric muscular failure [47]. A velocity loss threshold of 10% has been shown to produce substantially higher mean concentric velocity compared to 30% thresholds during the barbell back squat, while optimal power velocities during the barbell hip thrust exercise have been identified for mean velocity (0.92 m/s), mean propulsive velocity (1.03 m/s), and peak velocity (1.73 m/s) [48, 49]. As a result, immediate feedback through VBT identifies and tracks an athlete's progress while also monitoring fatigue to promote efficient training sessions.

Plyometric training promotes maximal force production by utilizing the stretch-shortening cycle [50]. Jump squat plyometric variations have shown to improve maximum strength, vertical jump, and sprinting performance, influencing the high-velocity end of the force-velocity curve [51–53]. Plyometrics may be enhanced when combined with a heavy resistance exercise influenced by the effects of post-activation potentiation [22, 49]. When applied during warm-up activities, squat jumps using 12.8 to 16.6% of athlete's body mass held by a plate have led to enhancements in 40-m sprinting performance [53].

Speed-Power

Exercises performed explosively with an intent to promote velocity are required to improve speed and power. Traditionally, Olympic weightlifting movements have been used for power development, but the extreme shoulder ROM and valgus elbow stress contraindicate these movements for baseball players. Less technically demanding Olympic weightlifting variations, such as the mid-thigh clean pull, have been shown to produce similar peak ground reaction forces and RFD as power clean variations, while plyometric training has the same effect on jump height [12, 54]. Kettlebell swings are a safe alternative to Olympic weightlifting that include similar movements with a high degree of transfer of strength and power [55]. Kettlebell swing, due to high medial hamstring activation and hip extension properties, has been shown to produce a high ratio of horizontal-to-vertical ground reaction forces [56]. Also, speed trap bar training is an effective method to enhance peak power output, force, and RFD with minimal skill requirement and biomechanical advantages [57, 58]. Improvements in sprint time, velocity, average acceleration, power, and concentric muscle activation during the countermovement jump were also observed with Olympic weightlifting variations [59, 60].

Developing linear speed and COD performance to respond quickly with efficient acceleration and deceleration mechanics are vital for on-field success. Eight weeks of jump squat training with real-time force, velocity, and power feedback via linear displacement transducers has been shown to improve RFD, countermovement jump height, and sprint acceleration [51]. As traditional resistance training models have led to improved knee flexor strength, high-velocity elastic band training with similar loads increases resistance at the end range of motion improves knee flexor concentric peak torque, movement frequency, and 30-m sprinting performance [61]. Horizontal movements, such as resisted bounding, focus on reaching maximal horizontal distances at a 45° angle with less gravitational forces acting against the movement while enhancing triple extension that is essential for sprinting [62]. While resisted sprinting, e.g., sleds, serves to improve stride length and RFD during the drive phase, assisted sprinting drills increase the ability to move quickly at supra-maximal velocities promoting stride frequency leading to improved sprint performance under both modes [46, 63–66]. Regarding agility performance, training strategies with a reactive component may improve athletes' cognitive decision-making and perceptual abilities [62, 67]. Resisted (RP) and assisted plyometrics (AP) have also shown to improve agility T-test and zig-zag COD time by improving neuromuscular adaptations including decreasing antagonist coactivation after AP, while RP may increase motor unit recruitment [64, 65].

Core Control

Executing efficient athletic baseball activities involve sufficient neuromuscular control and proprioceptive properties developed from the local and global systems that make up the core. As forces are being initiated from the ground and are transferred along the kinetic chain, a stable core musculature is needed to ensure the accuracy of movements. Exercises that target the lumbopelvic-hip complex (LPHC), including the transverse abdominals, multifidus, rectus abdominis, and the oblique abdominals, help control perturbations while maintaining structural integrity [68].

Arm Care

To resist the decelerative forces acting upon the glenohumeral joint, including exercises within a proper baseball strength and conditioning program is essential to help stabilize the joint dynamically while helping its role during overhead throwing motions [69]. As energy is being transferred from the lower extremity to the glenohumeral joint, elbow, wrist, and hand, the scapula also needs to possess appropriate stability and mobility for optimal velocity gains [70]. Exercises targeting the scapula are needed to facilitate force and energy transfer during overhead throwing motions by increasing muscle activation and strength development [71]. Also, the likelihood of sustaining rotator cuff tears and impingement have been associated with scapular instability [72]. The reduction in injury susceptibility and efficient proximal to distal sequencing may be accomplished with combined LPHC and scapular stability exercises with higher activation patterns such as planks and banded quarter squats on a balance board, lateral monster walks, shoulder taps, and slide board lateral lunges [19]. Exercises which aid scapular and shoulder stability can be accomplished in various positions (Fig. 5). The bird dog exercise with high-intensity perturbations has also been shown to elicit high maximum voluntary contractions due to the direct loading in the prone position [73].

Overview of Offseason Programming

Factors and Considerations

The baseball player's offseason consists of time dedicated to rest, recovery, and rejuvenation both physically and psychologically. On-field, athletes endure cumulative changes to neuromuscular and cognitive functions demanding much-needed restoration to optimize recovery. Specifically, for the baseball athlete, cumulative stress on the dynamic and static stabilizers of the upper and lower extremities leads to ROM changes over the course of a competitive season [14]. Baseball players likely need a period of rest to fully recover from the physical demands induced by the competitive season. An offseason program should provide the athlete with ample time for recuperation and rejuvenation from baseball-specific activities followed by a preparatory and transition period leading into the competitive season (Table 1).

Offseason Programming

In the following section, we'll review a sample of an offseason program for a minor league baseball player (Table 2). For reference, spring training starts in March for minor league players, advancing to the competitive season in April, and concluding in September. These principles can be adapted based on the unique schedule at different competitive levels of baseball, but the principles remain the same.

Phase I: Recuperation and Recovery

The competitive season concludes the first week of September, typically. Athletes are instructed to avoid all baseball-specific activities for approximately 2–4 weeks to allow optimal recovery of the endured physical/psychological tax. This phase involves transition from sport-

Fig. 5 Isometric prone "Y" with perturbations for scapular/shoulder stability

specific to active-rest facilitating psychological rest, relaxation, and biological regeneration maintaining a low level of physical preparation [74]. Movement and ROM are prioritized to optimize and restore anatomical deficits accrued throughout the season. This time should be reflective of the recovery/recuperation needs of the athlete to allow physical and mental rejuvenation. Complete cessation should be avoided; activities involving bodyweight movements (mobility/flexibility) should be prioritized to enhance ROM.

Post-season, overhead athletes have endured significant physiological damage needing repair and recovery. Due to the physical and psychological demands of prolonged periods of a season, athletes are in demand of a recuperation period to reduce tissue stress and damage that ensues over a competitive season. The post-season recovery period promotes peripheral blood flow and enhances muscle protein turnover [75]. Reinke et al. [75] found a post-season recuperation period of 2–4 weeks to be sufficient for recovery in adult soccer players.

Before re-engaging in functional strength training, the athlete should focus on restoring ROM deficits from the end season before the initiation of strength training. Significant ROM variances occur due to in-season workload causing the need for restoring hip and shoulder ROM. Deficits in these areas as well as others throughout the kinetic chain predispose athletes to injury. For pitchers, decreased hip flexion and internal rotation (IR) are associated with elbow and shoulder pain [76–78]. Both pitchers and position players demonstrate decreased bilateral hip ROM from pre-season to post-season [76]. Limited ROM of the shoulder has also been correlated with throwing arm injuries [79, 80]. Restoring hip and shoulder ROM should be a priority during the offseason recuperation and recovery phase.

Phase II: Reconditioning

After the recovery and recuperation period, the reconditioning phase begins in early October. This phase progressively immerses the athlete into the offseason training program with a focus on exercise technique, higher training volumes, and lighter loads. The goals of the reconditioning phase include increasing work capacity and elevating general physical adaptations and abilities [74]. The reconditioning period is typically 4 weeks in duration. The reconditioning phase consists of 4 weekly sessions separated into upper body (UB) and lower body (LB) splits.

Phase III: Accumulative Strength

The accumulative strength phase is designed to improve the baseball athlete's maximal strength and power. Split routines during the offseason prove beneficial due to decreased on-field workload leaving the athlete a greater recovery period between work-bouts allowing for increased volumes and partial body focus [81]. This phase begins in November and

Table 1 An outline of offseason strength periodization from the end of the competitive season to the following spring training. Month 1 is an active rest period. Months 2 through 4 represent the preparatory period. Months 5 and 6 are a transition period between the preparatory period and the competitive period

Month 1—September ***End season*** **Active rest**	**Month 2—October** ***Offseason*** **Preparatory period**	**Month 3—November** ***Offseason***	**Month 4—December** ***Offseason***	**Month 5/6—January/Feb** ***Pre-season*** **Transition period**
Recuperation/recovery	Reconditioning	Accumulative strength	Strength-speed	Absolute power/sport-specifics
Muscle/tissue repair	Light loads 60–70% 1RM	Moderate loads 80–85% 1RM	Moderate to heavy loads 80–90% 1RM	Heavy loads/plyos/reactive movements 85–90% 1RM
Movement/ROM	High volumes 2×3 sets @ 8–10 reps	Moderate volumes 3–4 sets @ 6–8 reps	Moderate volumes 3–4 sets @ 6–8 reps	Low to moderate volumes 2–4 sets @ 3–5 reps

Table 2 An example off-season baseball strength and conditioning program

Active rest			
Monday LB: • Banded ankle squats *(2× 10 rocks/side)* • Banded hip distractions *(1 min per movement-frontal/sagittal plane at hip joint)* • Pigeon pose *(30 sec. per leg)* • Physio-ball hip circles *(2× 10 oscillations-clockwise/counter-clockwise)*	Tuesday UB: • Foam roll wall slides *(2× 10 slides)* • Banded tornadoes *(2× 5/way)* • UB banded shoulder distractions *(2× 20 sec./side)* • Side lying foam roll reach *(2× 10/side)*	Thursday LB: • OH banded squats *(2× 6–8)* • Banded hip distractions *(1 min per movement-frontal/sagittal plane)* • Quad hip flexor stretch *(2× 10–12 leans per way)* • Physio-ball hip circles *(2× 10 oscillations-clockwise/counter--clockwise)*	Friday UB: • Prone dowel scap holds *(2× 20 sec. w/ perturbations)* • Elevated band pull apart *(2× 10 pulls)* • Banded tornadoes *(2× 5/way)* • Bench-dowel t-spine mobility *(2× 8–10 rocks)*
Preparatory period—reconditioning			
Monday LB: • BW or goblet squat *(2× 8–10 reps)* • Lunges with weighted vest *(2× 8/leg)* • Dowel RDL *(2× 10)* • Squat jumps *(2× 8)*	Tuesday UB: • Physio-ball push-ups *(2× 8 reps)* • DB press *(2× 8–10 reps)* • Chest supported DB row *(3× 8 reps)* • Banded face-pull *(2× 10 reps)* • Chin-up *(2× 6–8 reps)*	Thursday LB: • Hex deadlift *(3× 8 reps)* • RFE split squat *(2× 8/leg)* • Goblet lateral lunge *(2× 8 reps/side)* • Band pull-through *(3× 10 reps)* • Physio-ball hamstring *(2× 10 reps)*	Friday UB: • Plate swimmers *(2× 12 reps)* • Physio Y's/T's *(2× 5/way)* • SA standing cable press *(2× 8 reps/arm)* • Standing cable row *(3× 8 reps)* • Chin-up *(2× 8 reps)*
Preparatory period—accumulative strength			
Monday LB: • Safety squat *(3× 6 reps)* • Rev. lunge *(3× 6/leg)* • DB RDL *(3× 6 reps)* • Goblet lateral lunge *(3× 6/leg)*	Tuesday UB: • Push-ups *(3× 6 reps)* • SA cable/DB press *(3× 6 reps/arm)* • 3-point DB row *(3× 6 reps/arm)* • Chin-up *(3× 6 reps)* • Face-pulls (rope) *(3× 6 reps)*	Thursday LB: • Bulgarian split squat *(3× 6 reps/leg)* • Hex deadlift *(3× 6 reps)* • Goblet lateral lunge *(3× 6 reps/side)* • SL DB RDL *(3× 6/leg)* • Band pull-through *(3× 8 reps)*	Friday UB: • Plate swimmers *(2× 12 reps)* • Physio Y's/T's *(2× 5/way)* • SA standing cable press *(2× 8 reps/arm)* • Standing cable row *(3× 8 reps)* • Chin-up *(2× 8 reps)*
Preparatory period—strength-speed			
Monday LB: • Goblet squat with pause *(3× 6 reps)* • Vested repeat step-ups *(3× 6 reps/leg)* • DB squat jumps *(3× 8 reps)* • Weight rebound lateral lunges *(3× 6 reps/leg)*	Tuesday UB: • Ecc. explosive push-ups *(3× 6 reps)* • Speed banded bench press *(3 × 8 reps)* • Band/cable pull isometric *(3× 20 sec. holds)* • Banded speed row *(3× 8 reps)*	Thursday LB: • Hex deadlift *(4× 6 reps)* • Depth drop to jump *(4× 5 reps)* • Bulgarian split squat *(3× 6 reps/leg)* • SL bounds (hops) *(3× 6 reps/leg)* • Explosive band pull-through *(3× 8 reps)* • Weighted resisted skaters *(3× 6 reps/leg)*	Friday UB: • Plate swimmers *(2× 12 reps)* • Prone scap holds *(3× 20 sec. holds)* • Ecc. push-ups *(3× 6 reps)* • MB push slams *(3× 8 reps)* • Explosive cable press *(3× 6/arm)* • Plate drops *(3× 10 reps)* • Seated sled pulls *(3× 8 reps)*
Transition period—absolute power/sport-specific			
Monday LB: • Hex deadlift *(3× 5 reps)* • Squat jumps (3× 5 reps) • Bulgarian split squat *(2× 5 reps)* • SL low box bounds *(2× 5 reps/leg)* • DB lateral lunge *(3× 5 reps)* • Shuffle-shuffle reach repeats (arm side/glove side) *(3× 5/side)* • BB hip lifts *(3× 5 reps)*	Tuesday UB: • Explosive chest pass *(2× 5 reps)* • SA cable punch *(2× 5 reps/arm)* • DB press *(3× 5 reps)* • Explosive push-up *(3× 5 reps)* • Landmine press *(2× 5 reps/arm)* • DB row *(3× 5 reps/arm)* • Band pull (speed) *(2× 10 reps)*	Thursday LB: • Safety squat *(4× 3 reps)* • Depth drop to jump *(4× 3 reps)* • DB step-ups *(2× 5 reps/leg)* • Band explosive step-ups *(3× 5 reps/leg)* • Partner-assisted lateral lunge (reactive) *(3× 5 reps/leg)* • KB swings *(3× 10)*	Friday UB: • Rotational MB toss *(2× 5 reps/side)* • SA DB press *(3× 5 reps/arm)* • SA cable punch *(2× 5 reps/arm)* • MB push-slams *(3× 10 reps)* • Explosive push-pull *(2× 5 reps/side)* • SA cable row *(2× 5 reps/arm)* • Band pull *(speed) (2× 10 reps)*

LB lower body, *UB* upper body, *OH* overhead, *BW* body weight, *RDL* Romanian deadlift, *DB* dumbbell, *RFE* rear foot elevated, *SA* single arm, *SL* single leg, *Ecc*. eccentric, *MB* medicine ball, *KB* kettlebell

typically lasts 4–6 weeks but can vary based on an athlete's training age and technical skill. Sport-specific training and technical baseball elements are initiated in this phase at moderate volumes to increase work capacity [74]. As the end of this phase nears, the volume should decrease to prepare for greater intensity in phase IV.

Phase IV: Strength-Speed

Strength-speed is an important quality for sprinting, jumping, and reactive team sports. Phase IV involves the later portion of the accumulative phase in preparation for the intensity required during baseball competition. This phase should last 2–3 weeks, ending in December or early January. Utilization of complex training has proven effective in deriving force application and enhancing movement speed while in loaded positions [82]. Complex training is defined as a form of combination training utilizing high-loaded functional movements in succession with light-load power exercises of biomechanical similarity [83]. An example of complex training is a deadlift followed by countermovement jumps. The exercise provided should correlate to physical attributes developed in regeneration phase with the application of technical skills necessary for sport performance [74].

Phase V: Precompetitive Phase (Absolute Power/Sport-Specifics/Plyometrics)

Phase V is important relative to the wholesome make-up of the athlete and respective capabilities. Exercise prescription should be warranted based on overall progression and attenuated strength and power from previous phases. The precompetitive realm begins approximately mid-late January and into February prior to the onset of spring training lasting approximately 4–6 weeks. Training during the precompetitive phase is dedicated to 90% sport-specific activities and skill-based exercises [74]. Training volume is decreased while intensity is increased aiding the conversion of maximal strength to power. During this phase, absolute power and plyometric training should supplement sport-specific training. Furthermore, a low volume of resistance training should continue during this phase. Combined resistance and plyometric training may be more effective for increasing strength, jump, and sprint performance than plyometric training alone [84].

Conclusion

Strength and conditioning programs for baseball players must understand the unique needs and demands of the sport and the athletes. We have overviewed many of the concepts and principles to effectively build an offseason training program designed to minimize injuries and enhance performance.

Compliance with Ethical Standards

Conflict of Interest Brooks Klein, Daniel Cobian, Goldy Simmons, and Michael Reinold declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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