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The Benefits of Block Periodization in Track and Field for Advanced Athletes

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***Abstract*: Block periodization, also known as strength-power periodization (SPP), is a training method for high performing track and field athletes. Sprinters and field athletes, in particular, require explosive techniques as well as variation in their training. This is done through sequential concentrated loads and constructed phases of training which include separate hypertrophy and strength phases. This literature review highlights the benefits of block periodization for track and field athletes as opposed to other methods of periodized training in to improve explosive strength.**

***Keywords*: block periodization, strength power periodization, track and field, mesocycle, macrocycle, microcycle.**

I. INTRODUCTION

In recent decades, sports training has become a calculated process that requires immense planning and research. Unlike coaches of the past, who worked intuitively to train athletes, many coaches today apply the periodization theory as part of an athlete's training regiment. However, many players and coaches still struggle to understand its application. The objective of periodization is to instill a long-term training process of periods and cycles that are based on an all-around approach that includes specificity, intensity, and volume.[1] For track and field, in particular, block periodization has been found to be most effective. It emphasizes overload, variation, and specificity which is especially helpful for maximizing strength-power exercises thus effective in boosting the tapering and peaking phase leading up to big a competition. This literature review supports the idea that block periodization is the best approach for high performance training in track and field, particularly for advanced athletes who should administer strength exercises in variation so that overtraining is minimized and performance is built up over time.

II. WHAT IS PERIODIZATION

Periodization, in essence, is the process of training in periods and phases beginning with basic training. The athlete will then progress to more specific training as he or she approaches competition. The goal of periodization is to maximize the development of strength, speed-strength, and endurance strength with the purpose of peaking at a specific time which also helps to reduce chances for injury, stagnation, and overtraining through the means of variation.[2] A training cycle of periodization can last from 8-35 weeks and sub training cycle can last from 2-8 weeks in total.

More specifically, track and field consists of varying events from sprinting, hurdling, long-distance running, jumping, and throwing. While all these events require some level of strength, events like long-distance running requires endurance and sprinting requires explosive technique. Mechanics in track and field require that an athlete have a higher level of strength than skill or even technique. Compared to other sports, the skill gap in track and field is much smaller and technique plays a smaller role in winning a race. For instance, in the 100 meter dash, the athlete is sprinting as hard as they can in a straight line. This is far simpler than team sports such as basketball where players must learn to keep their eyes up, dribble then shoot a basketball, and play through contact. Training, therefore, is crucial in track and field to maximize the strength that an individual can produce and control. Ultimately, strength should be a priority in track and field training.

III. MACROCYCLE, MESOCYCLE, AND MICROCYCLE

The base to any periodization program is the annual plan or macrocycle which is a future timeline of projected competition. This macrocycle is then broken into separate phases or months of programming called mesocycles which include general preparation or special training sessions, competitions, peak phases, and points of transition.[3] The

mesocycle may also be broken up in these phases for advanced athletes due to the increased variation required for them to continuously progress in an efficient manner. Within a mesocycle, there are microcycles that typically last a week which illustrates day to day training. The subcategory of microcycles includes four training principles to control fatigue and optimize adaptations through overload, variation, specificity, and reversibility.[3]

A. Overload

Overload is a training stimulus meant to push an athlete beyond normal levels of performance and results in high intensity training. Concentrated loads of exercises focus on one aspect of development at a time (endurance, strength, or speed) while trying to maintain every aspect of an athlete's development.[3] Each of these concentrated loads will then increase the effect of the following sequence creating a base in which each preceding sequence builds off of.

B. Variation

Variation is when overload and specificity is manipulated to prevent fatigue and training plateaus and to maximize adaption. This includes changing things as small as training volume, rest periods, intensity, type of exercise, and speed of movement. How often this variation must occur varies directly with the athlete. The more advanced or experienced the athlete, the more variation required to optimize adaption. If the athlete is less experienced, less variation may be needed to optimize their adaption. For advanced athletes, more intense training is required, but this training should be alternated with rest or light days as source of variation to provide time for the body to properly adapt and recover while preventing injury.[3]

C. Specificity

Specificity is used if the athlete's main goal is to transfer training to sports performance rather than gaining absolute strength. Specificity is split into two different aspects: mechanical specificity and metabolic specificity. Metabolic specificity is training solely through the intensity of energy usage while mechanical specificity is training through the use of weights to increase intensity.[3] A subcategory of mechanical specificity is intermuscular and intramuscular tasks in which intramuscular tasks involve the motor skills of the movement of muscle fibers in a muscle while intermuscular tasks involve the full activation of multiple muscles. The more the training mimics the actual movements in performance, the more likely it is to transfer to sports performance.

D. Reversibility

Reversibility is when you lose fitness due to a lack of stimulus or a lack of variation. This can also happen due to poor fatigue management also known as involution. This is common even after variations of training in a 12-16 weeks period.

Aside from the four main training principles, there are additional training considerations. One of the first training considerations is the intensity. The intensity has to do with the rate at which energy is being used and can be split into two aspects, training intensity and exercise intensity.[3] Training intensity is how the lifting velocity is related to the actual weight lifted while exercise intensity is solely about the power output of a lift. The next consideration is volume which is the total work performed in a training session.

Another quality that can optimize periodization is to train with high effort. Doing this provides a better training stimulus for explosive athletes and can improve competition performance due to the mimicked high intensity of competition.[3] This also provides overload which is required for successful development in performance. The type of movement the athlete is performing will also have a great impact on how well the training will transfer to performance. Finally, the most important aspect to any type of training is that the athletes progress should be carefully monitored along with levels of fatigue. By monitoring progress and fatigue, the athlete of coach will be able to understand which type of training is more or less effective on the athlete.[3]

To further explain, the summated microcycle is the base to block periodization. Each summated microcycle has a specific volume and intensity and lasts four to six weeks to maximize the cumulative effect of block periodization.[3] It is then followed by an unload week or rest week that prevents overtraining and promotes adaptation (supercompensation). Functional overreaching can also be applied to promote a higher level of supercompensation and performance improvement by increasing the volume or intensity drastically for a very short period of time, typically a week.[3] Though it can be greatly beneficial, it is very risky and can easily result in chronic fatigue and overtraining if not done properly.

IV. WHAT IS BLOCK PERIODIZATION

The macrocycle, mesocycle, and microcycle of any periodization program are applied differently depending on an athlete's level. One issue that presents itself frequently concerns the peaking phase of periodization, which lasts a maximum of three weeks. "Peaking" in training is done to maximize an athlete's recovery and mental preparedness for an important event, such as a championship. Sometimes athletes need one peak in a season while some others need multiple peaks in a season depending on how many championships they will compete in.[4]

Block periodization, also known as strength-power periodization (SPP), caters to more advanced athletes who require more variation in their training through the usage of sequential concentrated loads. Conversely, daily undulating periodization (DUP) has been found to be more appropriate for lower performing athletes. DUP is a method of training in which the intensity, volume, and type of exercise alters everyday. Hartmann et al. has revealed that DUP is better for sports that need to have long periods of high performance while block periodization is better for sports that need to have peak performance for a minimal amount of time. SPP also runs the risk of showing lower performance at the beginning of the season and possible over training near the end of the season.

The first sequence includes hypertrophy (muscle growth) through high volume and moderately-low intensity training. This helps to build a higher work capacity for the following phase which is strength training. About 72 hours should be given between hypertrophy-strength programs and strength-power programs to maximize stimulus. Speed-strength workouts can take from 48 hours to 148 hours to recover from. Hypertrophy and strength-power training can be alternated in microcycles, but only if the muscle isn't trained during the regeneration phase.[5] Strength-power training can be paired with plyometric work only if given a 24 hour or 3 hours rest. To peak in track, ballistic training is seen as the most effective method to peak, although, heavy lifting explosively two days before a track meet can possibly improve performance. To maximize speed-strength over a short time in advanced athletes, strength-power training should be done twice a week.

In the strength training phase, heavier weights are lifted in order to improve maximum strength and build the foundation for the final phase, power training. During the power training phase, high velocity training is implemented to convert maximum strength from previous phases to a faster rate of force production.[5] Studies show that by training strength and power sequentially or by training both simultaneously, increases in the rate of force development (RFD) which can be maximized unlike when done alone. RFD is how fast and how much force an athlete can develop in a short period of time. The higher an athlete's RFD, the more explosive and fast the athlete is determined to be.

Over time, as training increases in intensity, the body builds up fitness and fatigue. Once the volume decreases, both the fitness and fatigue decrease but fitness decreases at a much slower rate than fatigue. While this occurs, the preparedness also increases which is the potential for an athlete to perform to their potential. One's preparedness to peak at a point when the athlete has to perform in an important competition is the end goal.

To illustrate how block periodization works to improve strength, Painter et al. examined 32 healthy NCAA Division I track athletes between the ages of 18 and 22. The focus of this experiment was strength and power but were also tested for hydration status, 1RM (Repetition Max) parallel squat, isometric mid thigh pull, and body composition. Endurance track athletes were excluded from the athlete pool. Measurements and testing took place at the beginning of week one, four, eight, and eleven during practices. For resistance training, it was done three days a week and lasted a maximum of one hour.[5] Hydration was tested to determine the level of fatigue, performance, and cognitive abilities. Isometric midthigh pulls were used to test the athletes overall isometric strength while 1RM parallel squats were used to test the dynamic strength of the athlete. Volume load, training intensity, and training efficiency were also calculated to provide further insight on the outcomes of each training method.

After 10-weeks of training, the block training method seems to be superior in efficiency in improving maximal strength and rate of force development. There was also a greater increase in dynamic strength and isometric strength in block periodization when looking at the volume completed by DUP compared to block periodization. The reason RFD was higher in block was most likely due to the final phase or power phase of the block periodization, which focused more on reducing fatigue while increasing power and explosiveness.[5] This led to lower accumulated fatigue for block training by the end of week 10 and higher levels of preparedness that improved RFD. In terms of volume load and work time in the weight room, block periodization is more efficient than DUP. The key to block periodization's success was its ability to manage fatigue well through alternations of light and heavy days while the flaw in DUP was its frequent training that led to more injury and fatigue by the end of 10 weeks.

V. PRE-SEASON VS. IN-SEASON

To simplify block periodization, you can think of it broken into three parts: accumulation, transmutation, and realization. Training begins with high volume and low intensity to low volume and high intensity as it moves from accumulation to realization. When athletes begin in accumulation, they are doing training that is supposed to improve their general fitness, but once transmutation begins training becomes more event orientated and athletes may separate into different training groups depending on event specific needs.[5]

A. Accumulation (off-season to preseason)

The accumulation phase of block periodization involves a general level of training in which the volume is relatively high while the intensity is low. By training this way, the body is able to induce hypertrophy to improve muscle mass, increase its work capacity, and improve its basic strength as a foundation for the following phases of block periodization.[5]

B. Transmutation (pre-season to early competition)

In the transmutation phase of block periodization, training becomes more specific and event oriented while the volume of training decreases and the intensity increases.[5] During this phase we are trying to build maximal strength from the increased work capacity we gained from the accumulation phase.

C. Realization (Middle competition to League/State Meets)

Finally, we have a realization in which we try to convert the maximal strength gained into explosive strength and improve our RFD and speed. Since we are in the competition phase, training becomes very specific to what event you are competing in for track. Training during this phase should be of very high intensity while keeping volume very low. Doing so would reduce unnecessary fatigue during the most important part of the year. Before leagues or states, a taper or planned overreaching may also be involved to help recovery from any accumulated fatigue and peak before very important meets.[5]

VI. UNDERSTANDING OVERREACH AND TAPER

To understand the effects of an overreach and taper on a track and field thrower's muscle architecture, throwing performance, and explosive ability, Bazyler et al. examined six NCAA Division I throwers were trained over 12 weeks using block periodization that comprised of a strength-endurance phase, then strength phase, and finally power phase. Strength training or resistance training occurred two to four times a week while throwing training and technique work were practiced two to three days a week. In the preseason or first three weeks of training, emphasis of training would be placed on preparing the athlete for their event. In the following nine weeks or in-season, the volume of work would decrease and training emphasis would be placed on technique work.[6] This periodization method would then be followed by a planned overreach week then a three week long taper. During the planned overreach, the volume of training would be dramatically increased while in the taper, the volume would be dramatically reduced to theoretically help aid recovery and adoption. During the testing done at the beginning of each training week muscle thickness, penetration angle, and fascicle length of the vastus lateralis was measured. Squat jump height and countermovement jump height were tested using 0kg to 40kg along with overhead and underhand shot put throws.[6] Since it was throwers they were testing, overhead and underhand throws were tested and measured due to their strong correlation to short put performance. To test for muscle thickness, pennation angle, and fascicle length, ultrasonography was used.

After the 12-week block periodization training, 1 week planned overreaching, and 3 week taper, an increase in vastus lateralis muscle thickness and pennation angle was found after the 12-week training, but no increase was found after the planned overreaching and taper.[6] On the other hand, an increase in competition throwing, countermovement jump peak force, and countermovement jump peak power. Knowing that strength and plyometric training sessions during the taper were reduced exponentially compared to the block periodization training, a lag time is seen between training stimulus and its effects on performance. During the block periodization training, muscle thickness is highly correlated to maximal leg extension force and could have aided in the future improvements in competition throwing and countermovement jump peak force and peak power.[6] In the taper, a reduction in volume and focus on neuromuscular power was shown to increase type IIa and IIx muscle fiber sizes, peak force, absolute power, and muscle activation. For the effectiveness of the functional overreaching, that data is inconclusive and due to the fact that there is very little previous research on the effects of planned overreaching in strength-power athletes and that only countermovement jump peak force seemed to be affected. We also do not know if it was the following taper that provided the performance increases or the functional

overreaching itself. Regardless, there was still a 6.3% mean increase in training tests and competition performance. In conclusion, the block periodization provided increase in muscle thickness while the functional overreaching and taper provided increases in explosive ability.

VII. CONCLUSION

The current research is consistent in its findings regarding the benefits of block periodization to improve explosiveness among track and field athletes for field events. However, there exists a lack of research for specific field events to make a conclusive remark on regarding block periodization. A closer look at each subfield of track and field may yield greater insights into block periodization specific to each sporting event while a comparison research could potentially reveal improved techniques in SPP.

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