Establishing Volume Load Parameters: A Different Look in Designing a Strength Training Periodization for Throwing Events

Nils Oliveto, MS, CSCS
Calgary, Alberta, Canada

Summary

This article suggests a way to establish throwing events volume load parameters and to incorporate these data into a resistance-training periodization designed by the strength coach. The method of calculating the throwing volume can be beneficial for a strength and conditioning professional looking for insightful information about an athlete's magnitude of throwing training outside the weight room.

Designing a periodization program involves the application of well-designed scientific theories (13). Every sport follows a periodization strategy that is specific to the athletic and physiological characteristics required for performance (4). The throwing events in track and field make no exception to the importance of choosing an appropriate training methodology (18). The success of a thrower (javelin, shot put, discus, and hammer) is obtained following rigorous resistance-training preparation, which includes strength development, speed work, and plyometrics, as well as hundreds of hours of technical throwing sessions (1). In order to obtain maximal strength and subsequently convert this strength gain into explosive power, training variables such as volume and intensity must be constantly manipulated throughout the year (14). Strength coaches keep a very close eye on the empirical data (sets, repetitions, and weight) for improvement to take place and for injuries to be prevented (9). The same holds true for the throwing-training component: the volume (number of throws) and the intensity (distance thrown) data must be recorded and included in a periodization designed by the track and field coach (17). It is therefore understandable that the periodization, for both the resistance and throwing workouts, should ideally be designed in a way in which one can be incorporated with the other. The purpose of this article is to suggest a way to establish throwing events volume load parameters and to incorporate these data into a resistance-training periodization designed by the strength coach. The method of calculating the throwing volume suggested in this article can be beneficial for a coach looking for insightful information about an athlete's magnitude of throwing training outside the weight room.

Russian Views About Throwing-Events Training

The following facts, suggested by Russian experts (11, 17, 19), can be considered when designing a strength-training program for a college thrower in track and field:

- Top priority of a thrower’s overall training preparation should be given to the throwing session.
- Strength training, although important, is secondary.
- Track coaches should keep a very detailed quantitative log (how many throws were taken, at what intensity, at what distance, and so forth) of their athletes and share the information with the strength and conditioning coach.
- The neural, muscular, and physiological stress that results from throwing an implement cannot be ignored when designing a strength-training program.
**Biomechanics of Throwing: Forces at the Moment of Release**

The amount of force required for an athlete to toss a throwing implement at a certain distance can indeed be quite high (6, 8, 12). For throwing events that require a rotational motion (hammer, discus, and sometimes the shot put), a motion in a curved path represents an accelerated movement. It therefore requires a force directed toward the center of rotation; namely, the centripetal force (3). In the case of the javelin throw, the force is applied in the axial direction of the implement (5).

Table 1 shows the total force (in N) generated at the moment of release using different hammer implements. These results were obtained from biomechanical analysis training data of the former German Democratic Republic’s top hammer throwers (7). An athlete throwing a 7.25-kg (16-lb) competition hammer at a distance of 80 m sustains a pulling force of 2,700 N. Taking into consideration the angular acceleration of the hammer head, this corresponds to a 700-lb pulling weight. The production of such great force results from the thrower’s accumulation of metabolically generated energy into muscular acceleration (2). High levels of muscular and metabolic fatigue, resulting from explosive throwing events activity that requires the use of the phosphagen/ATP energy system, can therefore be expected at the end of a throwing session (16).

### The Volume Load Formula: The Soviet Method

How can a strength coach, assuming that the coach has access to a detailed throwing-training log, use the quantitative throwing training volume information and incorporate it into a strength-training program? The answer could come from the Russian throwing philosophy. The former Soviet Union sports system has developed numerous Olympic champions during the years (19), especially in all 4 of the throwing events (shot put, discus, javelin, and hammer throw). Indeed, in the hammer throw, for instance, Soviet throwers have improved the world record 22 times since 1945. From 1972 to 1992 (except in the 1984 Los Angeles Olympics, in which the Iron Curtain countries boycotted the games), Soviet hammer throwers have won all Olympic and World Championship titles. The successful preparation and method of training depends on calculating the most essential parameters of loading (15). The former Soviet Union’s success in the throwing events gives a lot of credibility to the following mathematical formula that Russian coaches use to determine the volume load, expressed in kilograms, of each training session (17):

\[
\text{Volume load (kg)} = \text{Number of throws} \times \frac{\text{Distance (m)}}{4.5} \times 4.5 \quad \text{(a constant)}
\]

**Example Application of the Volume Load Formula**

An athlete has recorded the following results during a javelin throw training session (excluding warm-up throws): 6 throws measured at a distance of 65 m; 4 throws measured at 70 m; and 10 throws measured at 75 m. Using these data and the above volume load formula, we can come up with these subsequent calculations:

\[
\begin{align*}
6 \text{ throws} \times 65 \text{ m} \times 4.5 &= 1,755 \\
4 \text{ throws} \times 70 \text{ m} \times 4.5 &= 1,260 \\
10 \text{ throws} \times 75 \text{ m} \times 4.5 &= 3,375
\end{align*}
\]

Thus, 6,390 kg corresponds to the total volume load accumulated in that training session.

Zaitchuk (17) believes that typical resistance-training volumes for North American college throwers always exceed the throwing volume during the preparatory and competitive seasons. Russian coaches use the above formula to come up with an arbitrary figure that corresponds to what the athlete should lift in the weight room following their throwing practice (17) (note: the throwing training always precedes the resistance-training workout). It is suggested, for a strength coach who decides to use this formula for the first time, to follow this kind of approach. The following is an example of a precompetitive macrocycle high-intensity/low-volume resistance-training program (in kilograms) assuming the javelin throwing results recorded above were achieved on that same day.

**Power Snatch:** 65/5, 95/3, 100/2, 105/1, 115/1, 120/1  
(Total kg lifted = 1,150)

**Back Squats:** 100/10, 140/8, 180/4, 200/2  
(Total kg lifted = 2,740)
Bar Twists: 5 × 10 (50 kg)
(Total kg lifted = 2,500)
Total kg for this workout =
1,150 + 2,740 + 2,500 = 6,390

Because 6,390 kg was the calculated volume load resulting from the throwing session, the targeted volume load for the above weight-training example had to add up to 6,390 kg as well. This method of calculating volume loads can be used throughout the annual periodization plan of a thrower.

**Charting the Volume Load Formula**

Figure 1 shows how the volume and intensity of training vary during a monocycle (1 peak) for an athlete who needs to achieve 1 peak performance (typically used for a hammer/discus/javelin thrower with 1 outdoor season). The thrower’s coach will most likely use the basic high-volume/low-intensity approach during the preparatory phase, which is a very similar approach to what a strength coach would use. As the season progresses toward the main competitive phase, the emphasis in the throwing will shift to a low-volume/high-intensity approach. A strength coach applying the method of volume load calculations will still follow a very similar periodization curve designed by the thrower’s coach, avoiding at the same time a discrepancy between the targeted throwing-training goals and the strength-performance goals in the weight room. Let us consider the hypothetical case of a shot putter/discus thrower who begins to show below-average throwing performances resulting from fatigue during the precompetitive phase. The athlete’s coach might decide to decrease both the volume and the intensity of throwing training to help him recuperate. If such information is unavailable to a strength coach, there will be no decrease of volume and intensity, logically required as well, in the weight room. A poor throwing performance does not necessarily translate to poor strength-training results. The shot putter will still follow the original strength periodization program, even though his current throwing level would not encourage it. A discrepancy is therefore created; a possible case of overtraining might occur because the volume load of throwing and strength training have not gone together “hand-in-hand.”

**Increasing the Volume Load for the Following Season**

Bompa suggests that the total volume must increase by 20–30% from the previous year in order for the athlete to achieve higher performances in the upcoming season (1). He also recommends that the increase of volume should go as high as 40% from the previous season for an Olympic year. Most periodization charts use the y-axis to express volume and intensity in terms of a percentage. Although it is helpful for visualizing the periodization volume changes throughout the year, this kind of chart does not display accurate data. For instance, a volume load of 100% for a freshman walk-on athlete will be very different than a volume load of 100% for a senior All-American and Olympic hopeful. Different athletes should work at different levels of volume and intensity, depending on their previous year’s training results.

Figure 2 shows a similar chart (without the intensity curve), but the y-axis values have been substituted to hypothetical total volume load values in kilograms (data from the equation of calculated volume load of throwing + volume of weight lifted in the gym). Charting such a graph is not only a more accurate method of managing overall data training information, but it also helps the coaches in establishing an appropriate increase in total volume load for the following year. Another volume load curve that has been shifted upward by 20% demonstrates an increase in volume load from the previous year.

**Conclusion**

Designing a strength-training program taking into account throwing volume
parameters will help the athlete achieve the following:

- A decrease in the probability of injuries.
- A decrease in the probability of overtraining, with respect to both mental and physical overload (10).
- An increase in the probability of achieving top throwing performance at the most important meet or competition of the year.

It is understandable that such a method of calculating total lifting volume based on the volume of throwing can add a lot more work for a coach. However, the objective of this paper is to provide thought-provoking methods of using specific throwing information and to adapt those data to a high-performance strength training program. This article also highlights how important it is that a strength and conditioning specialist be adequately informed of the daily workload of a thrower outside the weight room. One cannot ignore the physiological stress that results from projecting a weighted implement at a certain distance recorded during a typical training session in all 4 of the throwing events in track and field. The practical applications of this volume load approach and the knowledge gained by all coaches involved in the development of throwers may result in greater performances.

**References**


*Nils Oliveto* is a sport science/human performance consultant in Waco, Texas.