VARIED WEIGHT SHOTS IN SPECIFIC POWER DEVELOPMENT

By L.A. Vasiliev

A study into the use of varied weight shots in the development of the specific power, attempting to determine the most effective frequency in alternating different weight implements and the optimal combination of the varied weights employed. The article is based on an abbreviated translation from Legkaya Atletika, Moscow, No8, 1984. Re-printed with permission from Modern Athlete and Coach.

The high level performances in modern track and field require coaches to find new ways to improve the effectiveness of the content and the organization of training procedures. Of special interest are training methods that make it possible to reach the desired performance level with the least time and effort.

The use of varied weight implements, compared with the widely employed repetitive method, is receiving a lot of attention lately in the development of specific power. The varied weight method is based on interchanging different weight implements during each exercise series, rather than repetitions with a fixed weight or a change from one weight to another from series to series. The effective variation of the frequency in alternating different weight implements is called the quantitative measure of variability. The effective combination of different weight implements is called the qualitative measure of variability.

The aim of our study was to determine the optimal quantitative and qualitative measures in specific power development in the women's shot put. The study employed three groups of athletes. Group 1 consisted of two top -ranked performers, Group 2 of twelve good athletes (Grade II) and Group 3 was made up of sixteen Grade Ill and novice shot putters. The athletes were allowed to perform the final delivery movement from any starting position. The weight of the shots ranged from 1 to 10 kg in multiples of 0.25 kg.

Six power parameters, reflecting the basic capacities of speed, strength and explosive power, were recorded. The parameters included acceleration (A), velocity (V), impulse force (I), force (F), work (A) and power (N). The oscillograms obtained were computer analyzed by Ivanova of the Scientific Research Institute of Physical Culture.

Four performance versions were devised to establish the quantitative measure of variability. Three of these incorporated frequent weight changes while the fourth version included only one change. The three variations were recorded as 1:1, 2:1 and 3:1. The fourth was labeled as 10:5. The first number indicates the number

of repetitions performed with a lighter than standard, the second the repetitions performed with a heavier than standard implement. The athletes involved executed each variation which was performed in 15 to 16 sets.

RESULTS

Quantitative Measures

The results indicated that, because of the bilateral influence, the frequent changes of the weight in all variations improved the speed of movement with both the lighter and the heavier implements. Lighter implements improved the force in the movement. However, the degree of improvement depended on the variation, i.e. on the effectiveness of the time relationship between direct and reverse effects. The effectiveness of the variations that employed frequent weight changes, basically different from the repetitive method, was evaluated in comparison with the repetitive method, as well as in comparison of the 10:5 version. When compared with the 10:5 version, which is close to the repetitive method, the following performance improvements were achieved:

- Velocity (V light): 14% (3:1) 11% (2:1) 2% (1:1)
- Velocity (V heavy): 20% (2:1) 19% (1:1) 13% (3:1)
- Force (F light): 11% (2:1) 6% (1:1) 1% (3:1)

The bilateral effect was negative only in respect to the force of the movement with the heavier implements. It reduced the values by the following percentages:

- Force (F heavy): 11% (1:1) 10% (3:1) 6% (2:1)

Qualitative Measures

The determination of qualitative measures of variability was narrowed down to establish the optimal combination of standard weight shots with non-standard weight implements in the selected variation of the 2:1 version. This approach maximized the specific power qualities of the athletes.

The ergograph measurements made it possible to evaluate the changes in movements occurring between the standard 4 kg shot with the varied weight implement, increased by 0.25 kg increments from 3 to 5 kg. Eight combinations were tested:

- 3 kg : 4 kg
- 3.25 kg : 4 kg

- 3.5 kg : 4 kg
- 3.75 kg : 4 kg
- 4.25 kg : 4 kg
- 4.5 kg : 4 kg
- 4.75 kg : 4 kg
- 5 kg : 4 kg

The effectiveness of each combination in comparison with the results achieved with the standard shot in the usual repetitive method were determined according to the above mentioned six performance parameters.

The analysis of the results indicated that the use of a non-standard implement just prior to the standard shot had some influence on the performance with the standard shot. The analysis also indicated that group 1 (top ranked athletes) achieved the fastest speeds with the standard shot when the light implement was nearly equal to the standard weight, i.e. the combination of 3.75 kg : 4 kg (a = 25.94 m/sec^2 0.22; V = 4.82 m/sec ± 0.13). For the other combinations the results were as follows:

- 3.25 kg : 4 kg
    - a = 24.60 m/s^2 ± 0.55
    - V = 4.55 m/s ± 0.17
- 3.50 kg : 4 kg
    - a = 25.37 m/s^2 ± 0.38
    - V = 4.63 m/s ± 0.15
- 4.25 kg : 4 kg
    - a = 25.63 rn/s^2 ± 0.27
    - V = 4.58 m/s ± 0.16
- 4.50 kg : 4 kg
    - a = 24.48 m/s^2 ± 0.29
    - V = 4.46 m/s ± 0.13

- 4.75 kg : 4 kg
    - a = 24.12 m/s^2 ± 0.28
    - V = 4.40 m/s ± 0.13
- 5.00 kg : 4 kg
    - a = 23.83 m/s^2 ± 0.45
    - V = 4.12 m/s ± 0.10

a = acceleration in m/sec

V = velocity in m/sec.

The most effective force was found in the combinations in which the lighter and heavier weights differed the least from the standard weight; i.e. 3.75 : 4 and 4.25 : 4. For example, in the combinations indicated, the impulse was 2.21 kg. s ± 0.09 and 2.26 kg. s ± 0.07 respectively, whereas in the combination 3.25 : 4 it dropped to 1.83 kg . s ± 006 and for the 5 : 4 combination it decreased to 1.88 kg . s ± 0.02.

The highest level of power in the movement with the standard weight shot in group 2 were found in combinations with lighter implements. The 3.5 : 4 variation produced the maximum results in all parameters (a = 17.34 m/sec^2 ± 0.44, V = 3.58 m/sec ± 0.25 and I = 1.64 kg. sec ± 0.04). The poorest combination turned out to be 4.75 : 4 (a = 15.48 m/sec^2 ± 0.31, V = 3.06 m/sec ± 0.37, I = 1.54 kg. sec ± 0.03). Based on the group I results, the 5 : 4 combination was not included in the study.

The best power values in group 3 were observed with a combination of the lightest implement and the standard weight shot, i.e. in the 3 : 4 version, in which the weight difference is the largest. However, even this version failed to produce values established with the 4 kg. shot in the use of the repetitive method. As the weight differences between the two implements were reduced, the values of all measured parameters decreased rapidly.

The results showed that the differences of weights, capable of producing a positive effect on the changes in the dynamic characteristics in movements with the standard weight shot in the varied weight method, become extremely fine as the athlete’s performance level improves.

CONCLUSIONS

The study of quantitative measures of variability has established the positive influence of frequent changes of the weight of the implements on specific power characteristics. The optimal combination appears to be 2 : 1 . This means that for maximum benefits in the varied weight method it is sufficient to repeat the actions twice.

The study of the qualitative measures of variability revealed the following:

QUALITY PARAMETER	GROUP I	II	III
SPEED a, V	3.75:4	3.50:4	3.00:4
FORCE F	3.75:4		
A	4.25:4	3.50:4	3.00:4
POWER I	4.25:4		
N	3.75:4	3.50:4	3.00:4

a = acceleration: V = velocity; F = force;
A = work; I = impulse force; N = power.

1. There is a correlation between the performance level of an athlete and the optimal weight of the implement used in combination with the standard weight shot (see table). For highly qualified athletes the weight difference should not exceed 0.25 kg. This applies to both, the lighter and the heavier than the standard shot. For grade 2 athletes the standard shot should be combined with a 0.5 kg lighter implement for maximum results.

2. For group Ill and the novices our study indicates the following:

    - The best values (equal to those observed in the repetitive method) are obtained when the lighter weight in the combination is 1 kg below the standard weight shot — the 3 : 4 variation.

    - When the weight difference is reduced, there is a negative interaction, causing the values of all measured parameters to decrease. Consequently, an uncontrolled use of varied weight shots does not bring the desired results and it would be better to use the repetitive method.