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ABSTRACT

The aim of this case study was to evaluate the long-term training periodization of the Greek record holder in women's hammer throw. The training parameters which were recorded and assessed in relation to the athlete's best throwing performance were: the strength training, the running and jumping exercises, the specific throws with implements of various weights and the imitation drills. The evaluation of the athlete's longitudinal planning showed that after 5 years of intensive training the throwing performance of the athlete was maximized. In addition, the training seasons 2003-2005 of the studied athlete were characterized by the high volume of the biomotor elements of strength, speed and throwing skills. The assessment of the interaction between the training means and the throwing performance showed that the athlete's improvement was strongly related to the upper-body strength and the lower-body explosive power. Furthermore, the imitation drills and the specific throws with implements contributed to the athlete's throwing development. In summary, this training report presents the performance progress of a world-class athlete emphasizing that the coach must be focused firstly on building-up the female thrower's strength and then to bridge the gap between the explosive power and technique.

Key Words: *periodization, training elements, record.*

INTRODUCTION

Hammer throw is one of the most complicated events in Athletics, demanding an outstanding throwing technique which requires strength, power, rhythm and balance (4). The contemporary hammer throwers must be able to create a higher rate of angular velocity through strength, power and balance, while the speed, the flexibility and the coordination are also crucial factors for an optimal throwing. Furthermore, the speed is the key point of the throwing technique and this is the reason why the hammer throw is literally referred as a "sprint" in a circle (11). In addition, the throwers' body mass and stature affect the amount of force needed to overcome inertia and their ability to rotate against centripetal forces, with the taller athletes with long arms to have an advantage of longer radius (5, 10).

The women's hammer throw event has a relatively short history, since it is a new discipline and recently established in the program of Athletics, presenting its debut in the Sydney 2000 Olympic Games. For this reason, the majority of the training literature is predominantly focused on the male athletes and it is used in order to provide general information for the hammer flight (12, 13). However, in the women event the lighter hammer and the existed morphological differences between genders alter the turns and the body tension in the hammer throw.

The performance in women's hammer throw is still developing in national and international level while the physical and technical demands in top-level women hammer throwers have been rapidly grown. The limited bibliography on the female hammer throwers refers mostly in case studies (8) or presents the biomechanical aspects of the hammer throw (1). Thus, the aim of this case study was to record the quantitative and qualitative training principles of an Olympic level female hammer thrower. Also, the objective of the current study was to compare the training parameters and the maximum throwing distance of the athlete in a 5-year cycle, from the season 2003-2004 to 2007-2008.

METHODS

The subject of this case study was Stilian Papadopoulou, the world-class athlete in women hammer throw. Her personal best is 72.10 m which is currently the Greek record in the women's hammer throw and it was achieved in the International Throwing Meeting "Sithonia", Greece, on 20th July 2008. She was born on 15/3/1982 and the best places in her carrier in the women hammer throw event of Athletics are as follows:

- 3rd in the EAA National Team Championships (2009)
- 3rd in the Mediterranean Games (2009)
- 6th in the EAA National Team Championships (2010)

- 6th in the EAA European Cup of Throws (2008)
- 8th in the IAAF World Athletics Final (2009)
- 11th in the Beijing Olympic Games (2008)

The athlete's best throwing performance as well as the training workouts for the seasons from 2003-2004 to 2007-2008 were analytically evaluated. The best competitive performance of the studied female thrower was recorded per year in order to assess the athlete's throwing development. Furthermore, the strength training, the running exercises (sprints & short distance runs), the jump exercises (horizontal & vertical), the throwing imitation drills as well the specific throws with weighted objects (med-balls, med-balls on ropes, barbells) were also recorded.

RESULTS

The studied female athlete gradually improved her competitive throwing performance in a time-period of 5 years. Her personal best (72.10 m) in hammer throw was achieved in the Olympic season of 2008 (national record). In this year the athlete was ranked in the 20th place of the IAAF World list in women hammer throw. At the time of this report, she is the first performer of all time in Greece. The athlete's best records per year from the season 2003-2004 to 2007-2008 are shown in Figure 1.

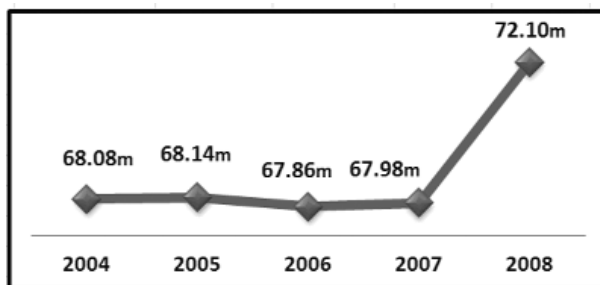


Figure 1: Athlete's performance development from 2004 to 2008.

The training workouts of the female thrower from the season of 2003-2004 to 2007-2008 showed that the strength training and the explosive power of the lower body (vertical & horizontal jumps) strongly interact to the throwing performance of the studied athlete. In addition, the strength and power exercises, which were applied by using imitation drills, seem to be of equal importance with the above interaction, focusing on the technique which leads to the development of the athlete's throwing performance. The Interaction between the thrower's competitive performance and the training elements are presented in Figure 2.

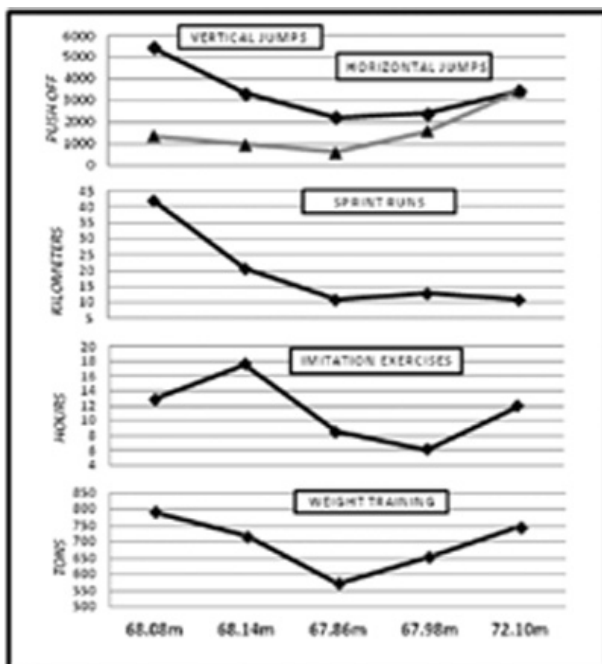


Figure 2: Interaction between the thrower's competitive performance and training elements.

The specific strength by using throwing drills in a variety of weights (med-ball, med-ball on ropes, barbell) showed that the training with heavier or lighter implements influenced mainly the throwing performance of the female athlete (Figure 3). In contrary, the running exercises (sprint & short distance runs) did not affect the best competitive performance (72.10 m) of the studied thrower on 20th July 2008.

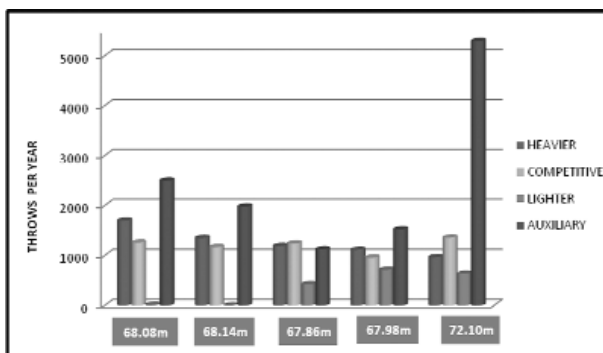


Figure 3: Interaction between the athlete's competitive performance and throwing skills with implements of various weights.

The performance in the tests which were applied in annual cycles is the most valid indicator of the studied thrower's strength, speed and power abilities. Considering this, it was shown that the competitive performance of the female athlete strongly interacted with her performance in standing and triple jump as well as with the back-ward overhead throws of a 5 kg med-ball. The combination of the dynamic weight-training exercises of the Olympic squat, the snatch and the power clean were reported with low interaction with the studied athlete's annual best throwing performance (Figure 4).

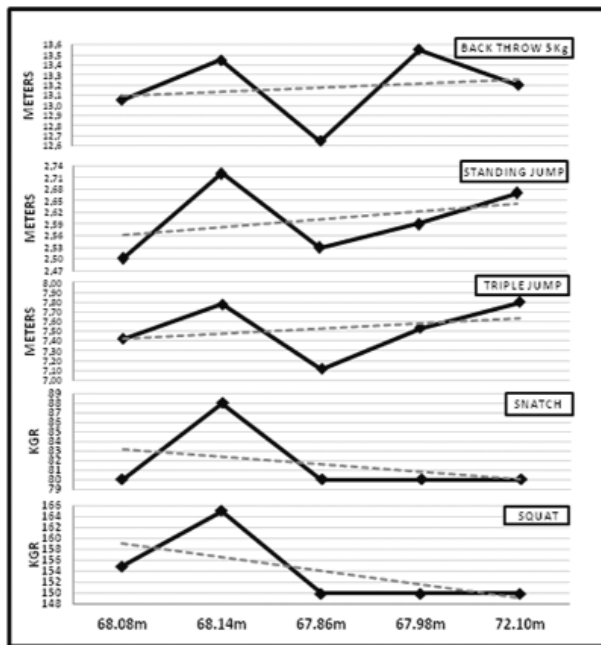


Figure 4: Interaction between the thrower's competitive performance and test indices.

DISCUSSION - CONCLUSION

The results of this study are in conjunction with the training literature which supports that the strength training is an important element in the longitudinal periodization of the female hammer throwers (2, 7). This case study recorded that the strength training strongly interacted with the best competitive performance of the evaluated athlete. More specifically, during the Olympic season of 2007-2008, in which the female thrower achieved her personal best of 72.10 m (national record) her strength training was increased compared to the annual planning of training of 2005-2006 and 2006-2007. A possible explanation for the above is that the studied athlete presented a "plateau" in her ex-

plosive strength so she increased the amount of weight training as high as in 750 tons per year during the 2007-2008 training season.

In highly qualified athletes the decisive factor for the ideal throwing performance is the strength-velocity readiness and the subtle ability to use it in directed movement skills. Therefore, the results of the present study confirmed that the sport-specific release movements of hammer throw with light and heavy implements play a vital role in the performance of the female thrower (12). In this training report, the longitudinal training periodization analysis of this female thrower presented that, during the season of 2007-2008, which was her best competition period, there was an outstanding increase in auxiliary throws with implements (5000 reps.). These exercises mainly require the use of the muscle groups that are responsible for the "driving action" in the hammer throw. Thus, the generated power (work/time) in the thrower through the use of hammers of various weights and lengths is an accurate predictor of the athlete's maximal performance in women hammer throw.

Regarding the speed, a recent study presented that there is no effect between the runs in a straight line and the rapid rotating direction of the hammer throw (3). The above can explain the low interaction between the short distance runs (30-60 m) with the best throwing performance of this high qualified athlete. In contrast, the high-speed imitation exercises seem to improve the thrower's technique in the turns resulting to a high release velocity ($\sim 27 \text{ m}\cdot\text{s}^{-1}$) which is the most distance-determining factor in the women hammer throw (6). The above result confirms that the hammer thrower should be a thrower first and then a lifter with the parameters of the maximization of the female throwing performance to be reported as the 75% technique and 25% strength (9).

The authors arrive at the conclusion that the coach must be focused on building-up the power of the female hammer thrower by using a combination of dynamic strength training and explosive power drills. Furthermore, the female throwers must be able to create a higher rate of angular velocity through the imitation exercises of various weights which will cause a radical change in the way they train. The training principles of this world-class thrower, which were presented in this case study, could provide valuable information to the coaches regarding the most accurate adjustments in the training workouts, especially in long-term training planning.

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