

METHODOLOGICAL ASPECTS OF WOMEN'S TRIPLE JUMP

By Vitold Kreer

Former triple jump champion, Vitold Kreer, discusses technical, physiological and developmental aspects of female triple jumpers, presents a series of recommended conditioning exercises and provides suggestions for training loads. The article is a condensed translation from Legkaya Atletika, Russia, No. 7 / 8, 1999. Re-printed with permission from Modern Athlete and Coach.

INTRODUCTION

Women took up the formerly prohibited event of triple jumping at the beginning of the twentieth century but it wasn't until 1993 when Anna Biryukova of Russia became the first female to beat the 15m barrier with a leap of 15.09m (5.45 + 4.08 + 5.09) at the world titles in Stuttgart. She was followed in 1995 by Jolanda Chen (15.03), Inessa Kravets and Iva Prandzheva (15.18m). Kravets' outstanding effort of 15.50m stands at this stage as the world record and the "15m club" had at the end of 1998 a total of seven members.

THE TAKEOFF MECHANICS

In the takeoff performance of the three triple jump phases an athlete has to overcome resistances to muscles and tendons that exceed the body weight by five to six times (hop 300kg + step 450kg + jump 300kg). The counter inertia forces increase here in proportion to the run-up speed (within 8.5 to 9.7 m/s) and the height of the trajectory in all three phases. A run-up velocity increased by 0.2 m/s over the last few strides, or a takeoff angle increased by 1° would add 16cm to the distance of the jump. However, it would at the same time require up to 10% more effort in each of the three phases.

The stretching and contraction of the muscles at each takeoff occurs during the amortization phase in which the takeoff leg and the spine help to reduce the inertia forces. As soon as the resistance to the stretching muscles exceeds the duress a powerful contraction begins. The takeoff leg starts its extension when the trunk begins to straighten and the body moves forward. The shorter the amortization phase, the more efficient is the transfer of this movement. In contrast, the later the straightening begins, the shorter will be the time left to move the body forward.

The capacity of the muscles to stretch and to contract powerfully in all phases of the triple jump decides the performance. In general, the amplitude of the

amortization for athletes with a well developed speed strength level should not exceed 10 to 15° in the hip joint and 40° in the knee joint.

PHYSIOLOGICAL DIFFERENCES

The height-weight indicators of women begin to grow rapidly at the age of 15 to 16 years, reaching a height-weight index of 350 to 360 g/cm at the age of 19 to 20 years. Adult female triple jumpers at the 1996 Olympic Games had an index of 370 to 380 g/cm, made up from 172 to 178 cm height and 62 to 65kg weight.

The ratio of active and passive (32 to 35%) fat mass is unfavorable for women in comparison to men. The same applied to the distribution of slow and fast twitch muscle fibres. These factors are responsible for the differences in the neuro-muscular systems (up to 30%). It is known that slow twitch muscle fibres have the task to initiate a movement, followed by an immediate engagement of fast twitch fibres to secure acceleration. It also is known that it is not possible to change slow twitch fibres into fast twitch fibres, although it is possible to change some of their qualities.

Women also differ from men in ratio of body height and leg length. They have weaker upper body, hip, back and abdominal muscles. However, all these differences are secondary to their shortcomings of instep strength, responsible for Achilles tendon inflammation and chronic knee pain. It should be noted here from a recent study that 50% of young potential jumpers suffered from instep abnormalities (Vorobinov).

Of further interest is the fact that the development of tendons and ligaments is considerably slower than the development of muscular strength. This creates an imbalance between muscular strength and the strength of ligaments and tendons. A balanced mechanical strength is usually not achieved before the age of 22 to 23 years, indicating the need for careful strengthening of tendons and ligaments at an early age.

Female athletes, who copy strength development exercises of male triple jumpers, make initially fast progress. Unfortunately this is followed, after a short stabilization phase, by a considerable drop in performance capacities, often shortening their sporting careers. The following recommendations appear therefore in order:

- The strengthening of the spine and ankle areas should gradually begin at a young age.
- Barbell exercises that involve bending and twisting movements should be avoided because they provoke spine injuries.

- Strengthening of abdominal and lower back muscle should continually take place.
- Full squats, standing presses and snatches should be avoided and replaced by similar exercises in prone position.
- Barbell bounces do not strengthen but only condense ankle muscles. Elastic loading with dynamic and plyometric methods is by far more effective.
- Tendons and ligaments should be protected by performing exercises on soft surfaces and wearing thick-soled shoes.
- After the technique of the exercises has been established, the number of repetitions is gradually increased but energy expenditure should still be under control.

WHAT ARE THE STRENGTH REQUIREMENTS OF FEMALE JUMPERS?

Only a coordinated application of different individual performance capacities makes it possible to perform efficiently the three explosive takeoffs required in the triple jump. The distance achieved in the triple jump depends on four major factors — strength, speed, psychic inspiration and technical mastery. The strength factor has here a leading role. It can often be observed that even a small technical deviation is responsible for a considerable drop in the distance among athletes who lack the necessary strength. On the other hand, jumpers with strength reserves are less influenced by technical shortcomings. Their high level speed strength compensates technical deficiencies.

Unfortunately we are faced with a paradox in the development of strength. On one hand, it is obvious that strength is a decisive factor in the triple jump performance. On the other hand, over-developed strength can bring negative results in blocking the movement amplitude and therefore distorting technical elements. Overdeveloped hypertrophy can restrict movement amplitude and the road to technical perfection.

Strength has an important task in the three takeoff phases in the fast transfer from yielding to overcoming muscular work. Consequently, the choice in strength development exercises should concentrate on dynamic movements which are in character, amplitude, tempo and rhythm closely related to the competition performance structure of the event. To avoid misunderstandings about weight training exercises it is necessary to draw attention to the following:

- Barbell exercises are only one of the many means available for strength development. Such exercises should not exceed 15 to 20% of the total development volume.

- Classic double-legged squats should be replaced by alternated single-leg squats. All snatching and pressing exercises should be executed fast in 5 to 8 repetitions with loads of 80 to 90% from the maximum.
- It is important to widen the approach to strength training by using different exercises, training means and training methods.

There is a large range of strength development exercises suitable to improve, besides strength, also movement coordination for rational technical elements. These exercises make up most of the conditioning training volume and include a variety of sprinting and jumping activities, such as jumps over 5 to 6 hurdles, bounding alternatively on both legs, 30 to 40m uphill sprints etc. All these strength development exercises are continued changed (even every couple of weeks) and the choice is widened to include more event specific exercise complexes.

For clarification we have divided a series of recommended exercises according to their capacity to overcome resistance into groups:

1. General strength — selective exercises for the development of all major muscle groups with weight training equipment.
2. Speed strength — development of the capacity of fast repetitive takeoffs by overcoming the resistance of the athlete's own body weight.
3. Explosive strength — development of the reactive takeoff capacity by using exercises with an additional load or resistance (30 to 50% of an athlete's own body weight).
4. Reactive strength — development of the muscular capacity of overcoming resistance following the building phase of the takeoff.
5. Specific strength — combinations to develop the specific capacity to perform fast repetitive takeoffs under changing conditions (5 to 7kg weight belt, rubber pulleys, 1 to 20 uphill jumps, jumping over the hurdles, jumps reaching for the basketball ring etc).

Finally a few recommendations for the coach:

- Pay special attention in strength development of female triple jumpers to their physiological differences.
- Combine strength development exercises with stretching and mobility exercises.
- Training loads are similar to male triple jumpers but the percentage of maximal intensity exercises should be reduced to 20 - 25%.

- Provide frequently variations by changing training means, methods and conditions. Avoiding monotony is particularly important for female jumpers.
- Don't forget the value of cross-country running. In some cases it is an excellent way to reduce body fat.

TRAINING LOADS

The development of international level women triple jumpers should definitely be based on a planned yearly training load (table 1). It is here necessary to find a rational structure for the plan as a whole, as well as single fractions. The plan can be based on the periodisation principle (Matveyev) with the load distributed according to the "leaping" (Vorobjov), "contrasting" (Drosjev) or "blocks" (Verhoshansky) formation.

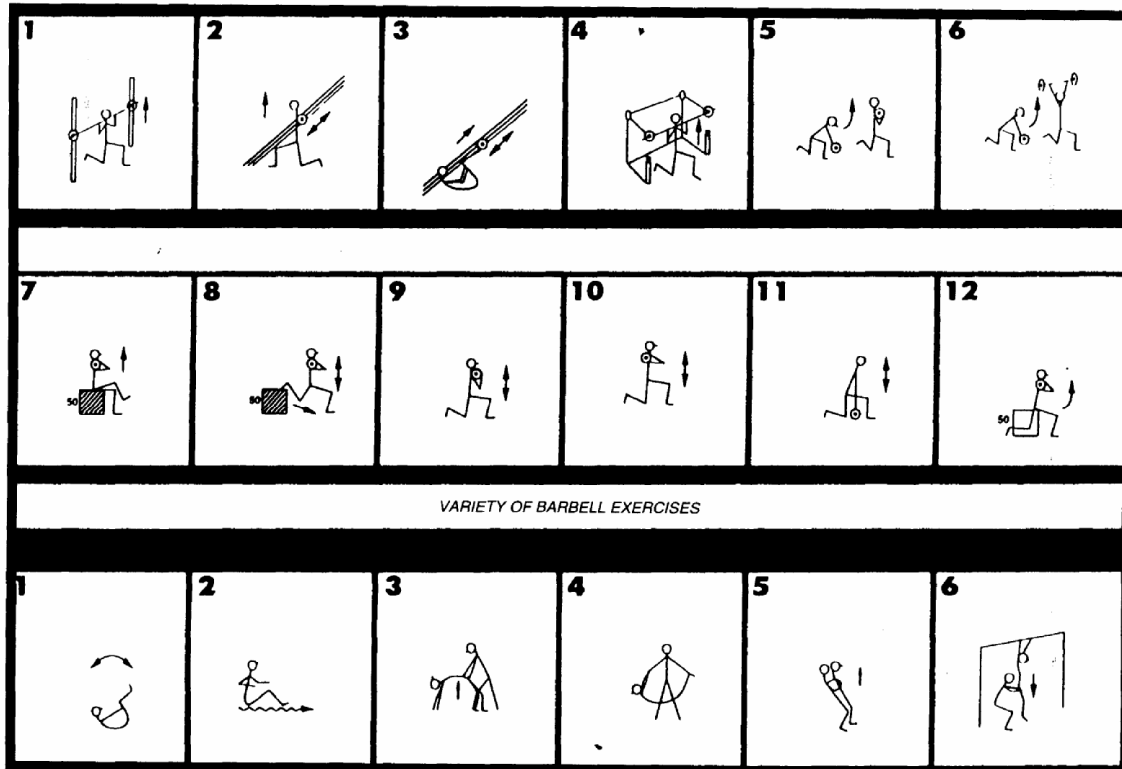
Practical experience over the last few years has shown that the most effective approach in the preparation for major events is a combination method in which technical and physical capacities are developed in parallel. This author believes that methodical changes in work capacity phases, training means and training methods allows athletes to reach top form 4 to 6 times in a six-month cycle.

Training session – 230 ± 20	General Strength – 600 ± 500 repetitions
Competitions – 15 ± 3	Speed strength – 5000 ± 1000 takeoffs
Sprints (96-100%) – 22 ± 3km	Explosive strength – 2500 ± 300 takeoffs
Running (70%) – 90 ± 10km	Reactive strength – 1000 ± 100 takeoffs
Run-ups – 250 ± 40	Specific strength – 300 ± 50 takeoffs
Short run-up takeoffs – 1000 ± 100	Restoration activities – 50 ± 10 sessions
Cross-country runs, game – 50 hr	Bounding (10-15 takeoffs) – 4000 ± 500

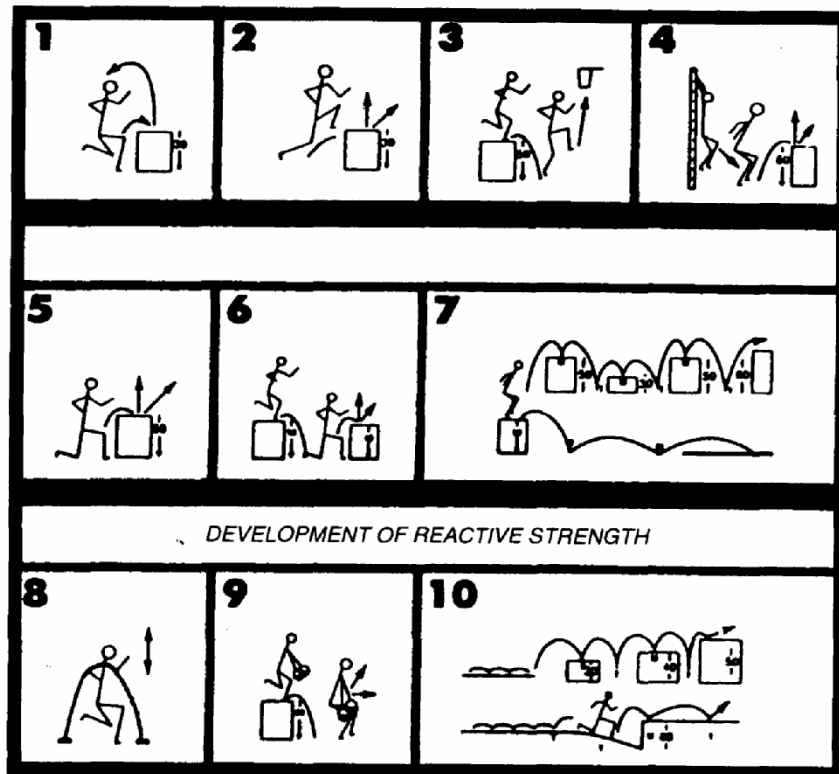
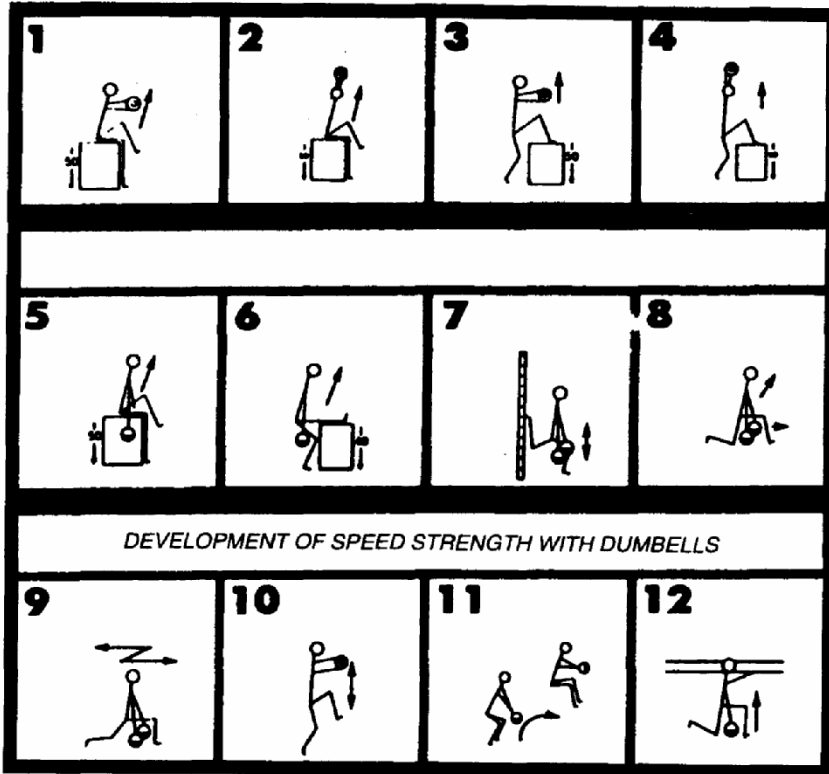
TABLE 1: Yearly training load for women triple jumpers






TRAINING MEANS		TRAINING PERIODS			
		GENERAL	STRENGTH	TECHNICAL	COMPETITION
SPRINT PREPARATION	Run-ups with a takeoff and jump (number)	-	3-4	8-10	10-12
	Sprints 30-80m (96-100%) (km)	-	0.7-1.0	0.7-0.8	-15-0.2
	Running, running exercises (km)	2.0-3.0	1.5-2.0	1.2-1.5	0.9-1.0
JUMPING PREPARATION	2-3-4-5-6 takeoffs from a 6-10 strides run-up	-	50-60	80-100	30-40
	Long jumps over hurdles (takeoffs)	-	10-20	10-15	6-0
	Hops and steps repetitions (8-15 takeoffs)	100	200	150	50
STRENGTH PREPARATION	General Strength (reps)	300	300	200	50
	Speed strength (takeoffs)	300	300	200	100
	Reactive strength (takeoffs)	-	100	100	30-40
	Explosive strength (takeoffs)	100	150	100	100
	Specific strength (takeoffs)	-	50	70	20

TABLE 2: A sample weekly training load for women triple jumpers during different training periods.








CORRECTIVE-RESTORATIVE EXERCISES








1		2		3		4		5		6		7		8	
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DEVELOPMENT OF GENERAL STRENGTH

9		10		11		12		13		14		15		16	
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DEVELOPMENT OF LEG POWER

1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16	
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