

# PLYOMETRICS FUNDAMENTALS of JUMPS

## **MUSCLE ACTION**



Exercise	Action	Muscle length
Dynamic	Concentric	Decreases
	Eccentric	Increases
Static	Isometric	No change

Knuttgen et Komi, Classification of exercise and muscle action types





Isometric



Concentric



Eccentric



Eccentric muscle action most important for athletics (and injury prevention)







Train your muscles at specific contraction speeds

### PLYOMETRIC TRAINING



### Jumps as a specific (strength) training method

- Reduced hypertrophy (little weight gain)
- Improved 'relative strength' / strength weight ratio
- · Enhanced intra- and intermuscular coordination
- Activation of fast twitch fibers



### STRETCH-SHORTENING CYCLE





### DORSIFLEXION



Utilise the stretch reflex (involuntary movement) and keep ground contact short Focus on eccentric phase of the movement Avoid plantarflexion





### DORSIFLEXION

Work on the 'antagonists' Tibialis anterior, extensor hallucis + digitorum longus Helps to avoid Achilles tendon injuries



### **BASIC JUMP PARAMETERS**



SF J.	Ho <mark>r. Velocit</mark> y imr Take-Ot	m <mark>edi</mark> ately before ff [m/s]	ore Ground contact Take		off angle [°]	
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100m Sprint	ca. 11	ca. 12	0.08-0.09	ca. 3		
Hurdle-Take Off	>8.5	>9.0	0.11-0.13	ca. 15		
Pole Vault	7.7-8.3	9.0-9.6	0.10-0.12	16-18*		
Triple Jump - Hop	9.1-9.5	10.2-10.6	0.10-0.13	15-17	13-16	
Triple Jump - Step	8.3-8.7	9.5-10.0	0.14-0.16	10-13 11-14		
Triple Jump - Jump	7.5-7.9	8.5-9.0	0.14-0.17	18-23		
Long Jump	9.2-9.7	10.3-11.0	0.10-0.13	19-22		
High Jump	6.0-7.5	7.0-8.5	0.14-0.19	40	-55	

Strüder, Scholz, et al., 2016

## LONG JUMP



	Target Performance [m]	Hor. Velocity [m/s]	Contact time Take-Off [s]	Take-Off Angle [°]	Vert. Take-Off Velocity [m/s]	Loss of hor. Velocity [m/s]	Swing leg velocity [°/s]
	6.00	8.7	0.12	19.9	2.7	1.2	748
women	6.35	9.0	0.12	20.0	2.8	1.2	759
	6.70	9.4	0.12	21.1	3.1	1.3	776
	7.00	9.7	0.12	19.6	2.9	1.3	762
men	7.50	10.0	0.12	20.3	3.1	1.4	812
	8.00	10.4	0.11	20.9	3.3	1.5	840

Killing 2008, adj. by Strüder, Scholz, et al., 2016

### REQUIREMENTS



Volker Herrmann

Quality of jumps / plyometrics depends on the following factors:

- Horizontal run-up velocity
- Take-Off Angle (and body position)
- Vertical Impulse (RFD / p<sub>avg</sub>)
- Optimized Ground Contact Times (Sprint vs High Jump)
- Hip- / Knee- / Ankle Joint Stiffness (reduced amortisation)
- Foot Plant (whole sole, except drop jump)





### REQUIREMENTS

#### **Higher & Further**

V Take-Off / Angle of Take-Off / Height of Centre of Mass





### **BODY CENTER of MASS**



# Flight phase and center of mass projection / center of gravity (COG):

Body rotates around the COG during flight phase

It can be repositioned around the COG (e.g long jump)





### TRAINING METHODS

**Isometric Jumps** 

**Repetitive Vertical Jumps** 

**Repetitive Horizontal Jumps** 

**Vertical Depth Jumps** 

**Speed Bounding** 

Drop Jumps





### **ISOMETRIC JUMPS**











Focus:	Vertical Impulse	When:	Gen. + Spec. P.	Horiz. Speed:	low
CNS Load:	medium	Structural Load:	high	Vert. Speed:	medium - high





Focus:	Hor. Impulse	When: Spec. P	. + Pre Comp	Horiz. Speed:	medium - high
CNS Load:	medium- high	Structural Load:	high	Vert. Speed:	medium
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## VERTICAL DEPTH JUMPS



Focus:	Vert. Impulse	When:	Pre Comp + Comp	Horiz. Speed:	low
CNS Load:	high	Structural Load:	high	Vert. Speed:	high







Focus:	Hor. + Vert. Imp.	When:	Pre Comp + Comp	Horiz. Speed:	high
CNS Load:	high	Structural Load:	high	Vert. Speed:	medium - high











## VOLUME per WEEK



Jumping Form	16 years	18 years	20 years	Example
Drop Jumps	20	25	30	6 x 4 reps
Isometric Jumps	100	125	150	4 x (4 x 8)
Rep. Vertical (Hurdle Jumps)	40	60	80	<b>4</b> x (2 x 6)
Rep. Horizontal Jumps	30	40	60	4x12
Vertical Depth Jumps	-	10	15	4x3
Speed Bounding	20	25	30	6x5

### **TEACHING the JUMPS**

#### Quality over quantity

Take-Off / run-up first, but isolated

Frequency towards the Take-Off

Hip extension

Lead leg action





#### **BOUNDING UPHILL**

- Vertical displacement (falling height) is reduced
- Emphasize on concentric action (reduced utilisation of SSC)
- Higher volume possible (hypetrophy for slow twitch)
- Can be used in Gen. Prep

#### Follow basic principles:

Slow to fast / general to specific / simple to complex / known to unknown

