

Plyometrie



*“De toepassing van
plyometrie binnen
de jeugdopleiding
van SC Cambuur”*

Ruben Eilander & Paul Harthoorn

Inhoudsopgave



- **Wat is plyometrie**
 - Mechanical Model of Plyometric exercise
 - Neurophysiological Model of Plyometric Exercise
- **Stretch-Shortening Cycle**
- **Waarom plyometrie**
- **Plyometrie vormen**
 - Eenbenig vs. tweebeinig
 - opbouw
 - Springen
 - Sprinten
 - COD & agility
- **Risico's**
- **Programmering van plyometrie**
- **Praktijk**
- **Bronnen**
- **Vragen**

Wat is plyometrie?



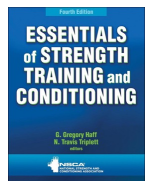
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Wat is plyometrie?



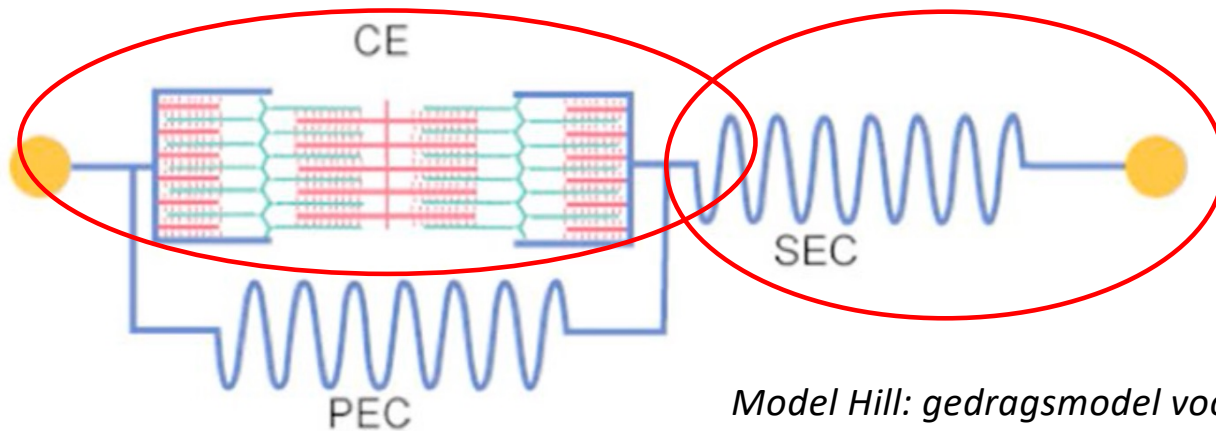
“Plyometric exercise refers to those activities that enable a muscle to reach maximal force in the shortest possible time.”

“Practically defined, plyometric exercise is a quick, powerful movement using a prestretch, or counter- movement, that involves the stretch-shortening cycle (SSC)”



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Mechanical Model of Plyometric Exercise



Model Hill: gedragsmodel voor de werking van de spieren

CE: het contractie element --> het deel dat voor de contractie zorgt;

SEC: het serie elastische element --> passieve elastische delen die in het verlengde van de CE-delen liggen;

(**PEC:** het parallel elastische element --> passieve elastische delen die evenwijdig aan de CE-delen liggen)



***Krachttraining en coördinatie;
een integratieve benadering***

Functie CE en SEC



Krachtenopbouw verloopt gladder

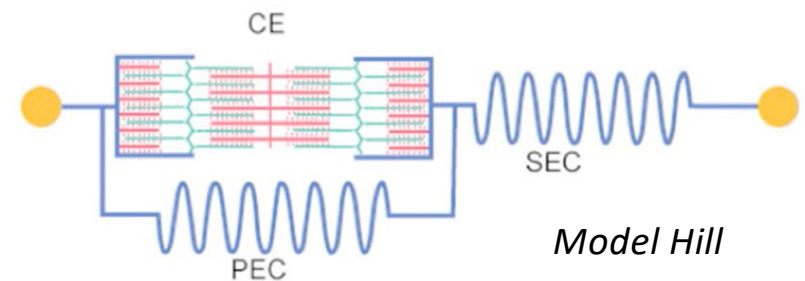
- Reguleren van kracht bij functionele bewegingen

Schokdemper voor inwerkende krachten

- Bewegingen controleren in een wisselende en onbekende omgeving

Opslaan van de energie van inwerkende krachten

- Elastische werking

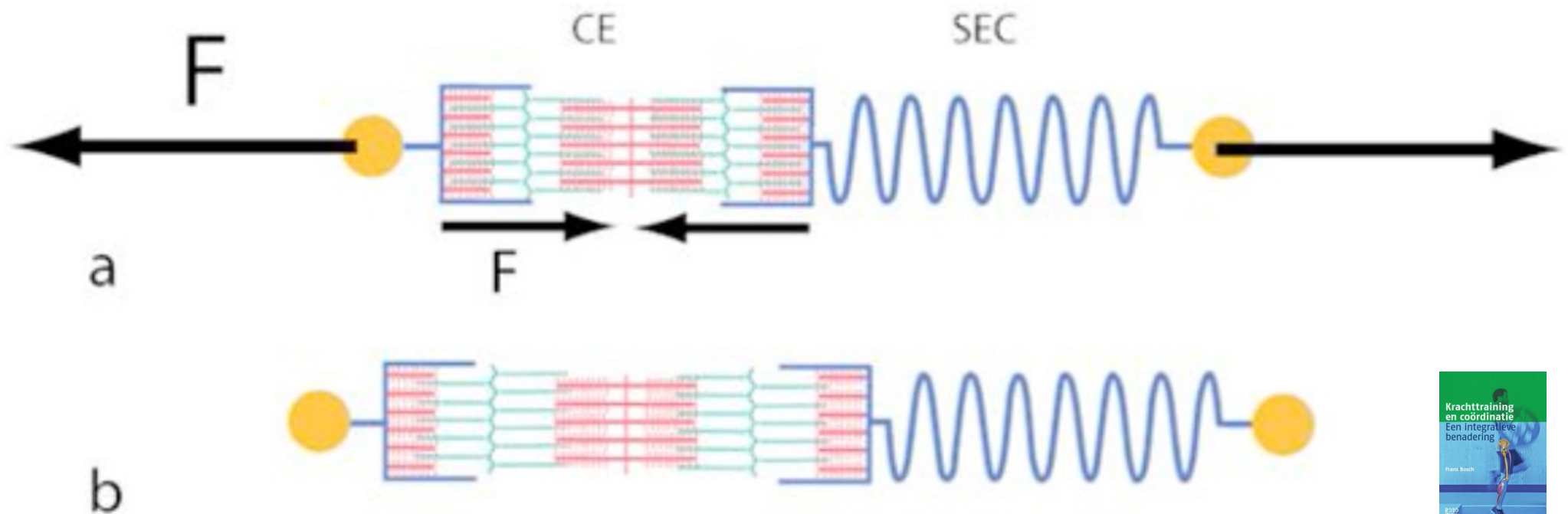


Model Hill



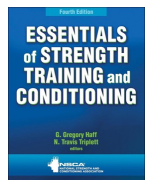
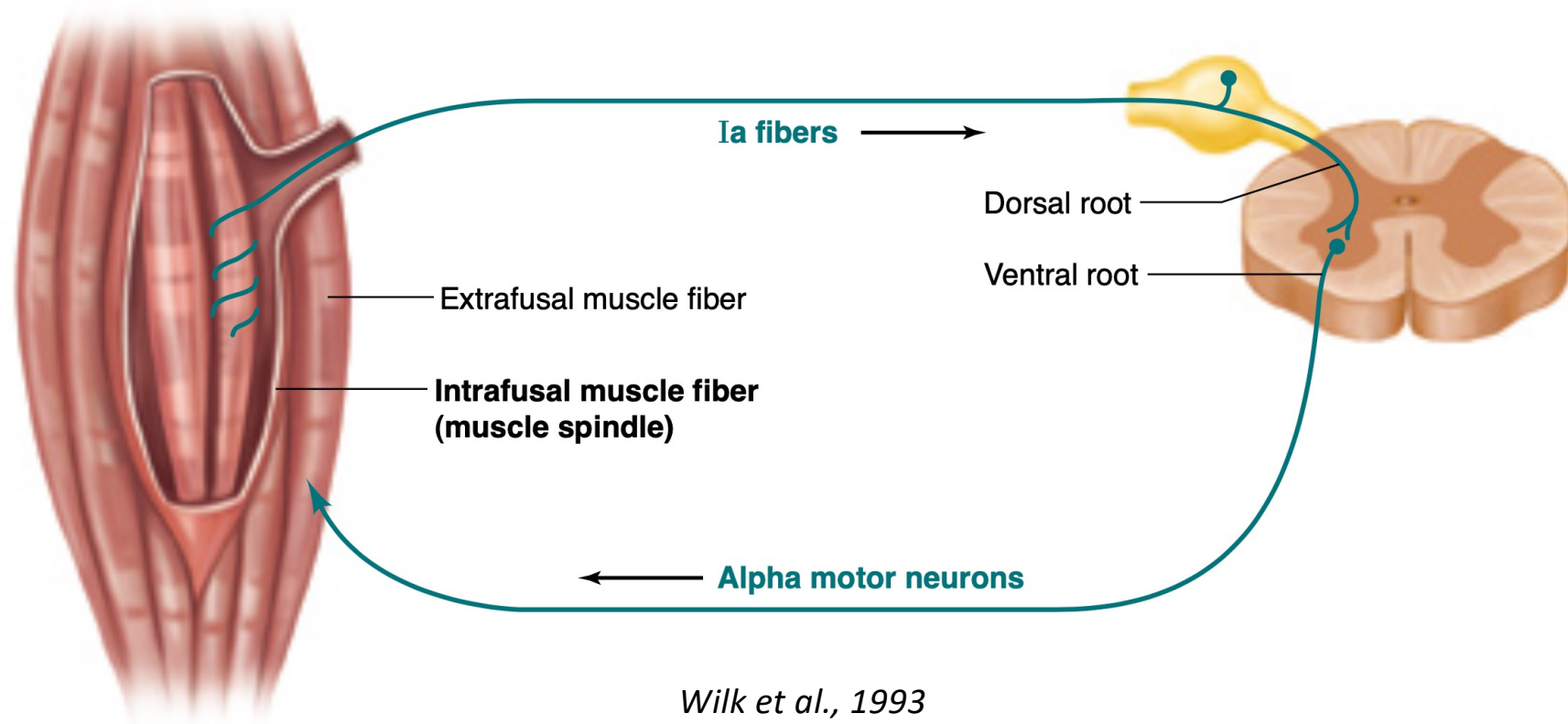
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een integratieve benadering*

Reactiviteit van de spier (elastische werking)



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Neurophysiological Model of Plyometric Exercise

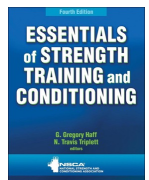


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Stretch-Shortening Cycle

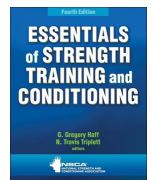
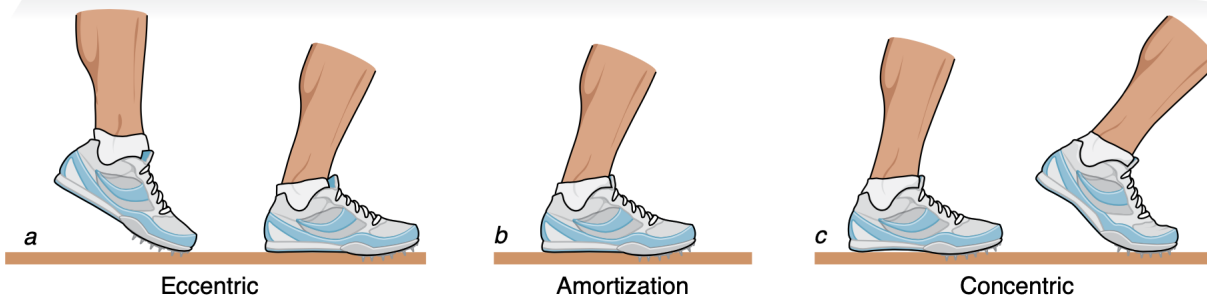
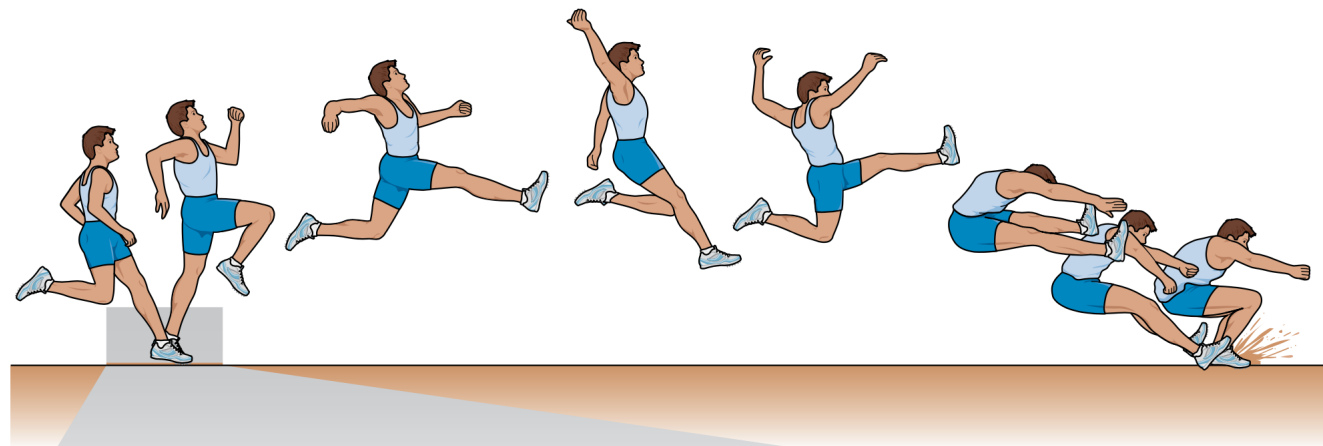


Fase	Actie	Fysiologische gebeurtenis
I - Eccentric	Stretch of the agonist muscle	- Elastic energy is stored in the series elastic component. - Muscle spindles are stimulated.
II – Amortization	Pause between fase I en III	- Type Ia afferent nerves synapse with alpha motor neurons. - Alpha motor neurons transmit signals to agonist muscle group.
III – Concentric	Shortening of agonist muscle fibers	- Elastic energy is released from the series elastic component. - Alpha motor neurons stimulate the agonist muscle group.



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Stretch-Shortening Cycle



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Stretch shortening cycles (SSC)



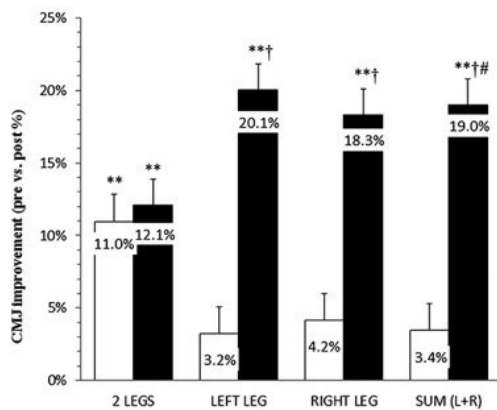
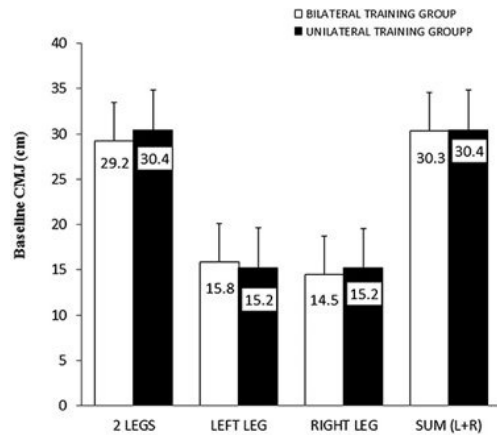
Exercise	Ground Contact Time (ms)	SSC Classification
Race Walking (4)	270-300	Slow
Sprinting (5)	80-90	Fast
Countermovement Jump (CMJ) (6)	500	Slow
Depth Jump (20cm – 60cm) (7, 8)	130-300	Fast / Slow
Long Jump (9)	140-170	Fast
Multiple Hurdle Jumps (10)	150	Fast
Basketball Lay-Up Shot (11)	218	Fast

Waarom plyometrie



Slow SSC	Fast SSC
Sportspecifiek	Sportspecifiek(er)
Atletisch vermogen maximaal kracht ↑	Atletisch vermogen Explosiviteit ↑
Fast-twitch spiervezels ↑	Fast-twitch spiervezels ↑
Stijfheid pezen ↑	Stijfheid pezen ↑
Neurale zenuwstelsel ↑	Neurale zenuwstelsel ↑
Botdichtheid ↑	Botdichtheid ↑

Plyometrie vormen; eenbenig vs. tweebeinig



	Week 1–3 sets	Week 4–6 sets	Repetitions
Bilateral training group			
1. Two-leg jumps for distance	2	3	10
2. Countermovement jumps	2	3	10
3. Lateral jumps	2	3	10
4. Box jumps	2	3	10
5. Jumps over hurdles	2	3	10
6. Drop jumps	2	3	10
7. Leg extensions	3	4	6 at 60% or 3 at 90% 1RM†
8. Leg curls	3	4	8 at 60% 1RM
Unilateral training group			
1. Hops	2	3	5 per leg
2. Single-leg countermovement jumps	2	3	5 per leg
3. Single-leg lateral jumps	2	3	5 per leg
4. Single-leg box jumps	2	3	5 per leg
5. Single-leg jumps over hurdles	2	3	5 per leg
6. Single-leg drop jumps	2	3	5 per leg
7. Single-leg leg extensions	3	4	6 at 60% or 3 at 90% 1RM†
8. Single-leg leg curls	3	4	8 at 60% 1RM

*1RM = 1 repetition maximum.

†The program was performed twice per week for 6 wk.

‡Performed on the first or the second session of each training week (see text for details).

Plyometrie vormen; opbouw



Fase	Focus
Excentrisch	Laden en correcte landing
Lage intensiteit	Fast SSC oefenen
Hoge intensiteit	Fast SSC + maximale output

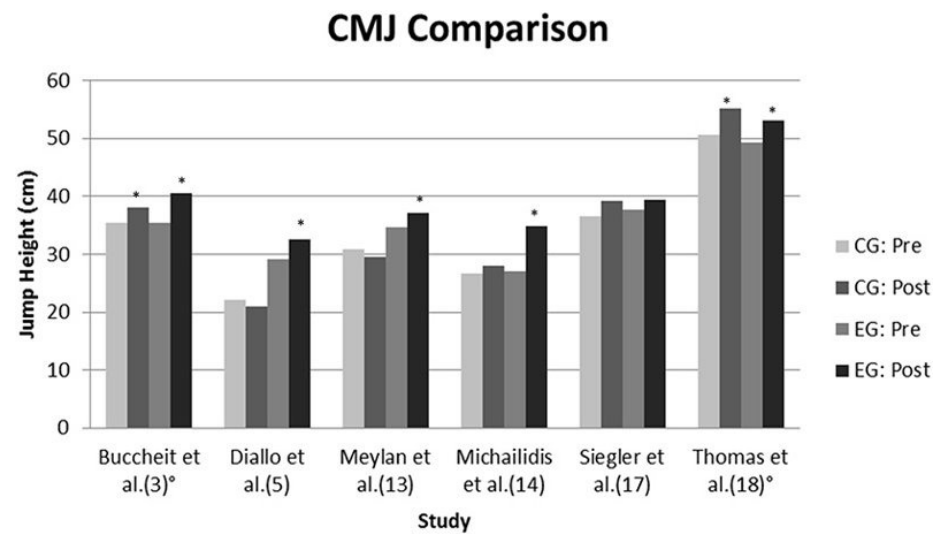
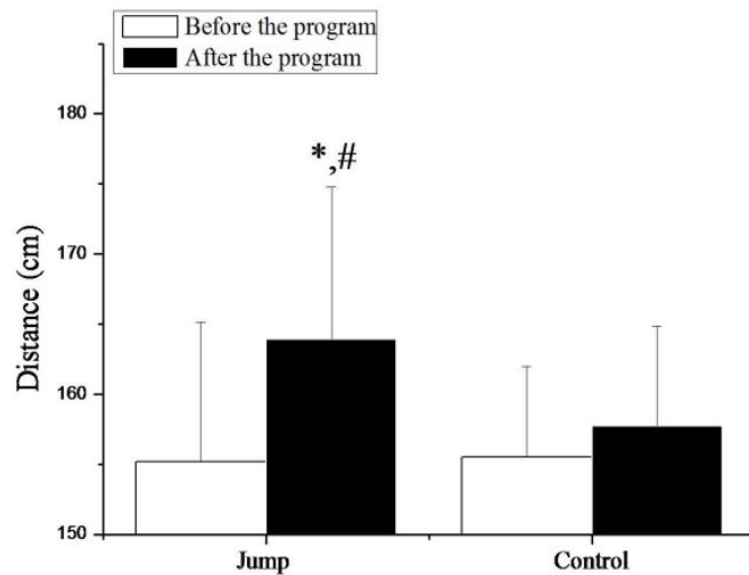
Plyometrie vormen; springen



Fast SSC vs. slow SSC

Explosieve kracht vs. maximaal kracht

Horizontaal vs. verticaal

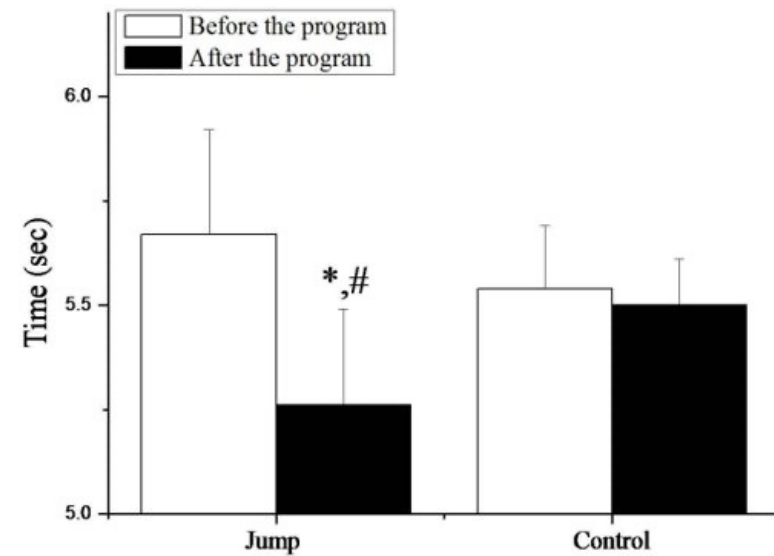
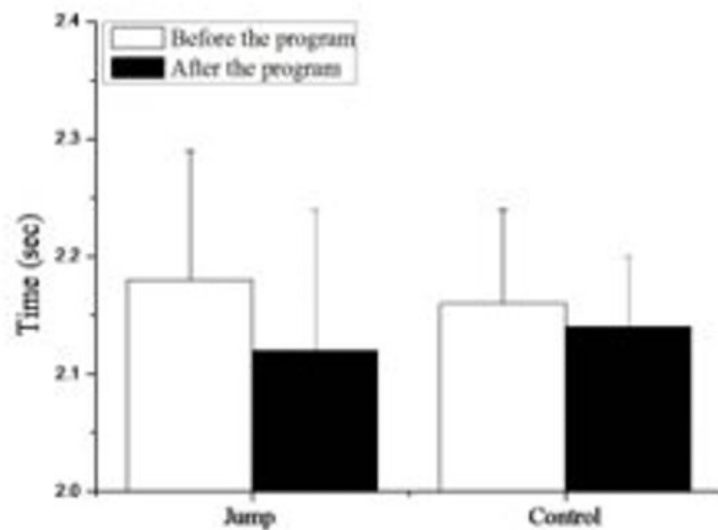


Plyometrie vormen; sprinten



Fast SSC vs. slow SSC

Horizontaal vs. verticaal



Plyometrie vormen; COD & agility

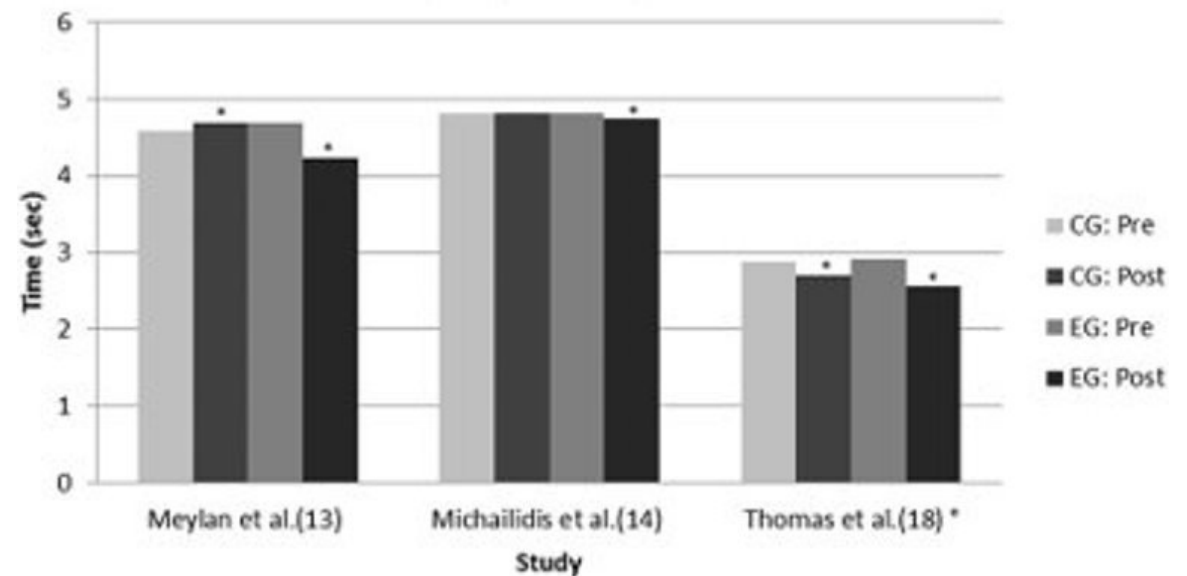


Fast SSC vs. slow SSC

Horizontaal vs. verticaal

Getraind vs. ongetraind

Agility Comparison



Plyometrisch trainen (risico's)

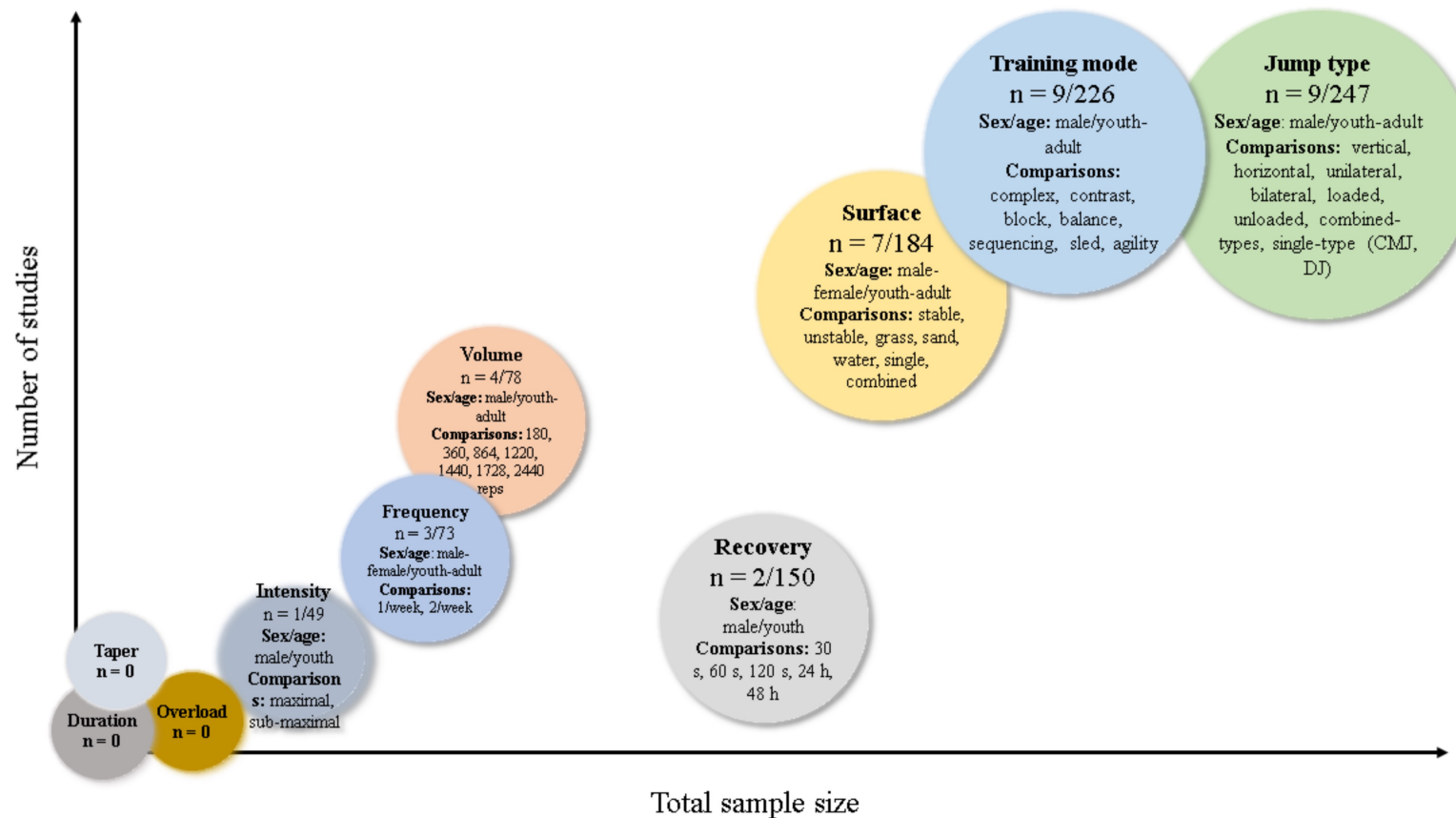


Verkeerde ontwikkeling groeischijven

Vaardigheden sporter

Impact training (is maar de vraag)

Programmering van plyometrie; meta-analyse



Programmering van plyometrie; meta-analyse



Frequentie → 1 a 2 keer per week

Volume → 80 sprongen per sessie (1 à 2x) of 140 tot 240 sprongen per week

Intensiteit → Maximaal of bijna maximaal

Rep rest → <15 seconden (indien nodig)

Set rest → 30 seconden of meer

Herstel → 24 – 48 uur of meer

Overload → Sprongverhoging van 10% per week.

Ondergrond → De juiste ondergrond (gras)

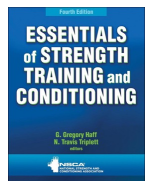


Programming Plyometric-Jump
Training in Soccer: A Review

Frequentie



48 - 72 uur ?



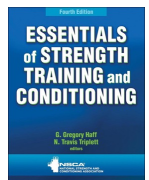
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Intensiteit



Factors Affecting the Intensity of Lower Body Plyometric Drills

Factor	Effect
Points of contact	The ground reaction force during single-leg lower body plyometric drills places more stress on an extremity's muscles, connective tissues, and joints than during double-leg plyometric drills.
Speed	Greater speed increases the intensity of the drill.
Height of the drill	The higher the body's center of gravity, the greater the force on landing.
Body weight	The greater the athlete's body weight, the more stress is placed on muscles, connective tissues, and joints. External weight (in the form of weight vests, ankle weights, and wrist weights) can be added to the body to increase a drill's intensity.



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Volume



Plyometric experience	Beginning volume*
Beginner (no experience)	80 to 100
Intermediate (some experience)	100 to 120
Advanced (considerable experience)	120 to 140



Onder ...



Onder ...



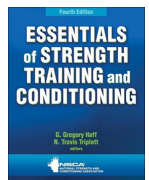
Onder ...



*Volume is given in contacts per session.

Grondcontact

Afstand



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Overload

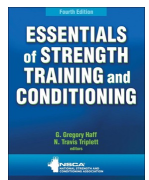


Progressieve overload

Frequentie

Volume

Intensiteit



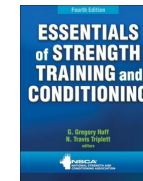
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Rust



Programming Plyometric-Jump
Training in Soccer: A Review

VS.



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Reps → 15 seconden of meer

Reps → 5 – 10 seconden

Sets → 30 seconden of meer

Sets → 2 – 3 minuten

Implementatie SCC



Off-season-mesocycle

Plyometrics (emphasis on landing mechanics)

Pre-season-mesocycle

Plyometrics: (emphasis on short GCT) multiple hops and jumps (bilateral and unilateral; multidirectional)

In-season-mesocycle

Plyometrics: (emphasis on short ground contact time and maximum jump height) depth jumps and bounds (bilateral and unilateral; multidirectional)

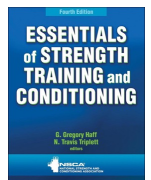
Voorwaarden

Techniek

Kracht

Snelheid

Balans



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Praktijk



Slow SSC

Fast SSC

CMJ (verticaal)

Zig Zag Hop

CMJ (horizontaal)

Sprinten

SL/ DL Squat-jump

Skipping

Bronnen



- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9230747/>
- Krachttraining en coördinatie: Een integratieve benadering (Frans Bosch)
- [https://journals.lww.com/nsca-scj/Fulltext/2014/08000/Strength and Conditioning for Soccer Players.1.aspx?utm_source=exacttarget](https://journals.lww.com/nsca-scj/Fulltext/2014/08000/Strength_and_Conditioning_for_Soccer_Players.1.aspx?utm_source=exacttarget)
- Essentials of Strength Training and Conditioning; NSCA
- [https://www.researchgate.net/publication/6460226 Does plyometric training improve vertical jump height A meta-analytical review Commentary](https://www.researchgate.net/publication/6460226_Does_plyometric_training_improve_vertical_jump_height_A_meta-analytical_review_Commentary)
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5260592/>
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Vragen



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