

Conditioning training of hockey juniors

Harri Hakkarainen

MD, MSc (Sport Science)



**WORLD
CHAMPIONSHIP
GERMANY**

Cologne - Mannheim
Gelsenkirchen

My Background

- Doctor of Medicine - Sports Doctor
- Bachelors degree in Sport Physiology, Biomechanics and Coaching
- Doctor / Physical conditioning trainer
 - Ice Hockey team Oulun Kärpät 2004 - 2008
 - 3 gold and 1 bronze
 - National Ice Hockey Team 2006 -
 - WC silver and bronze + Olympic bronze
 - Hockey Team Metallurg Magnitogorsk, Russia 2010 -
 - Individual players:
 - Niklas Bäckström, Kimmo Timonen, Tuomo Ruutu, Jussi Jokinen, Pekka Rinne, Niko Kapanen, Jarkko Immonen, Janne Pesonen, Lasse Kukkonen...



WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

My Background

- Doctor / Physical conditioning trainer
 - Track and Field
 - 3 World Championship medalists
 - Cross Country Skiing
 - 4 World Champion and Olympic medalists
- Sport Nutrition Specialist and/or Consultant
 - McLaren Formula-1 team
 - Jenson Button and Lewis Hamilton
 - Red Bull Formula-1 driver Sebastian Vettel

2010



**WORLD
CHAMPIONSHIP
GERMANY**
Cologne - Mannheim
Gelsenkirchen

Lecture topics

- 1) Important elements of junior condition training?
- 2) Basics of neuromuscular system
- 3) Biological maturation
- 4) Problems in western world among young athletes
- 5) Nervous system training in practise



Important elements of junior condition training

- The most important and difficult element **Is the Nervous System!**
- Nervous system = Speed, skill, agility, balance...
 - 100m dash, long jump, high jump... WR:s haven't improved significantly last 50 years
 - speed, skill, agility, balance improvement need
 - good brain - muscle coordination / motor skills
 - it comes out after thousands of correct repetitions specially in childhood
 - ability to activate fast muscle cells
 - if an athlete hasn't activated fast muscle cells during childhood, it is more difficult to get good results later
- Ability to activate and relax proper muscles
 - some muscles are accelerating movements, some decelerating movements, some are supporting other muscles...
 - **A COACH SHOULD KNOW THE MAIN MUSCLES OF MOVEMENTS AND EXERCISES !!!**

2010



**WORLD
CHAMPIONSHIP
GERMANY**
Cologne - Mannheim
Gelsenkirchen

Important elements of junior condition training

- Good core stability and muscle endurance
 - the most important part of the body is located around the center of gravity = MID BODY
 - today the muscle endurance and core stability is weak among young athletes in every sport
- Good cardiovascular condition and aerobic metabolism
 - they are the basis of all the other training
 - nowadays it is coming weaker and weaker
 - it needs minimum 45-60 min cardiovascular physical activity / day
 - it doesn't need to be jogging or biking - it can be skill, agility, muscle endurance, functional training with short recovery breaks

Important elements of junior condition training

- Structural changes in cardiovascular-, metabolic-, neuromuscular... system
 - not only short time functional changes
 - usually one summer improvement is caused only by functional changes in tissues
 - more enzymes, better technique, more liquid in blood
 - not permanent changes
 - structural changes needs thousands of repetitions and long term planning

2010

IIHF

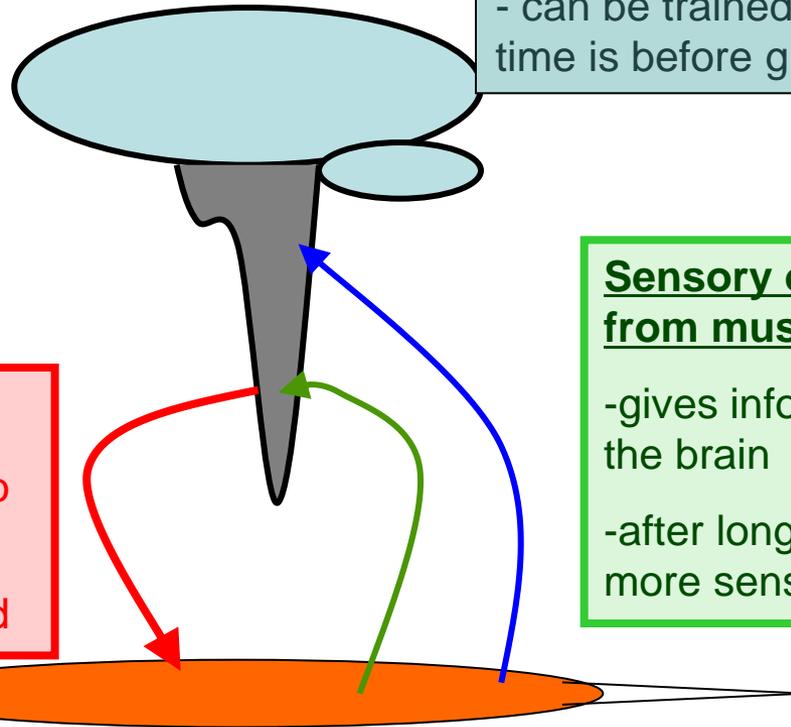


WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

NEUROMUSCULAR SYSTEM

Brain and its structures

- control and information collecting center of everything in sport
- can be trained in whole life, but the best time is before growth spurt



Motor nerve

- conduct the impulse = order to muscles
- effectiveness can be improved

Sensory organs and nerves from muscles

- gives information all the time to the brain
- after long term training can be more sensitive = more effective

Muscle cells

- just repeat the orders
- fast and slow - which have been activated, will grow and improve
- metabolism (aerobic / anaerobic)

2010



WORLD CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Basics of neuromuscular system

- Brain and its structures
 - give orders to motor functions (which it has learned)
 - control of movements (specific adaptation)
 - collect information (all correct and incorrect)
 - WE CAN IMPROVE BRAIN FUNCTIONS MUCH MORE THAN WE HAVE THOUGHT EARLIER
 - IT NEEDS THOUSANDS OF REPETITIONS UNDER DIFFERENT CONDITIONS
- Spinal cord
 - conduct the signals from brain to muscles and back
 - reflex center in very fast movements
 - some automatically learnt movements are already in the spinal cord level
 - WE CAN IMPROVE THE CONDUCTION VELOCITY IN SPINAL CORD LEVEL AND GET REFLEXES MORE EFFECTIVE BY USING FAST, NEW AND UNEXPECTED EXERCISES AND RHYTHMS



2010
IIHF
WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Basics of neuromuscular system

- Nerves from spinal cord to muscle and from muscle back to
 - conduct the nerve impulse to muscle and feedback from muscle
 - WE CAN IMPROVE THE CONDUCTION VELOCITY BY FAST, COORDINATION EXERCISES AND DOING DIFFERENT SPORTS DISCIPLINES
- Sensory organs inside the muscle cells
 - they can become more sensitive to movements, if we do different kind of sports = THEY ADAPT TO SAME MOVEMENTS QUITE EASILY, SO DONT KEEP DOING SAME EXCERSICE FOR A LONG TIME, CHANGE INTENSITY, RHYTHM, BODY POSITION....



WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Basics of neuromuscular system

- Muscle cells
 - "are just cells which are doing what they have been ordered to do"
 - big muscle cell can be slow if it has got slow impulses - small muscle cell can be fast if it has got fast movements
 - we can improve aerobic and alactic (<15 sec) metabolism easily with juniors, but lactic (> 15 sec) anaerobic metabolism is more difficult before growth spurt
 - concentrate e.g. 10x20m spurts before growth spurt and take 3x200m spurt after it
 - ALL PEOPLE HAVE ABOUT SAME NUMBER OF FAST AND SLOW MUSCLE CELLS AT BIRTH, BUT CELLS CAN ADAPT TO DIFFERENT WAYS DURING FIRST 8-10 YEARS OF LIFE
 - doing different sports and with different intensities, we can really activate all the muscle cell genes in our body



WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Basics of neuromuscular system

- IT IS POSSIBLE TO IMPROVE ALL LEVELS OF NEUROMUSCULAR SYSTEM, IF WE REMEMBER
 - to do different sports = before growth spurt track&field, football, basketball, wrestling, gymnastics...
 - to use different rhythms = not same rhythm adaptation in brain and reflex systems
 - to use different conditions and surfaces = outside, uphill, downhill, forest, swimming pool = brain, muscles, sensory organs... can adapt to different conditions



2010
IIHF
WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Basics of neuromuscular system

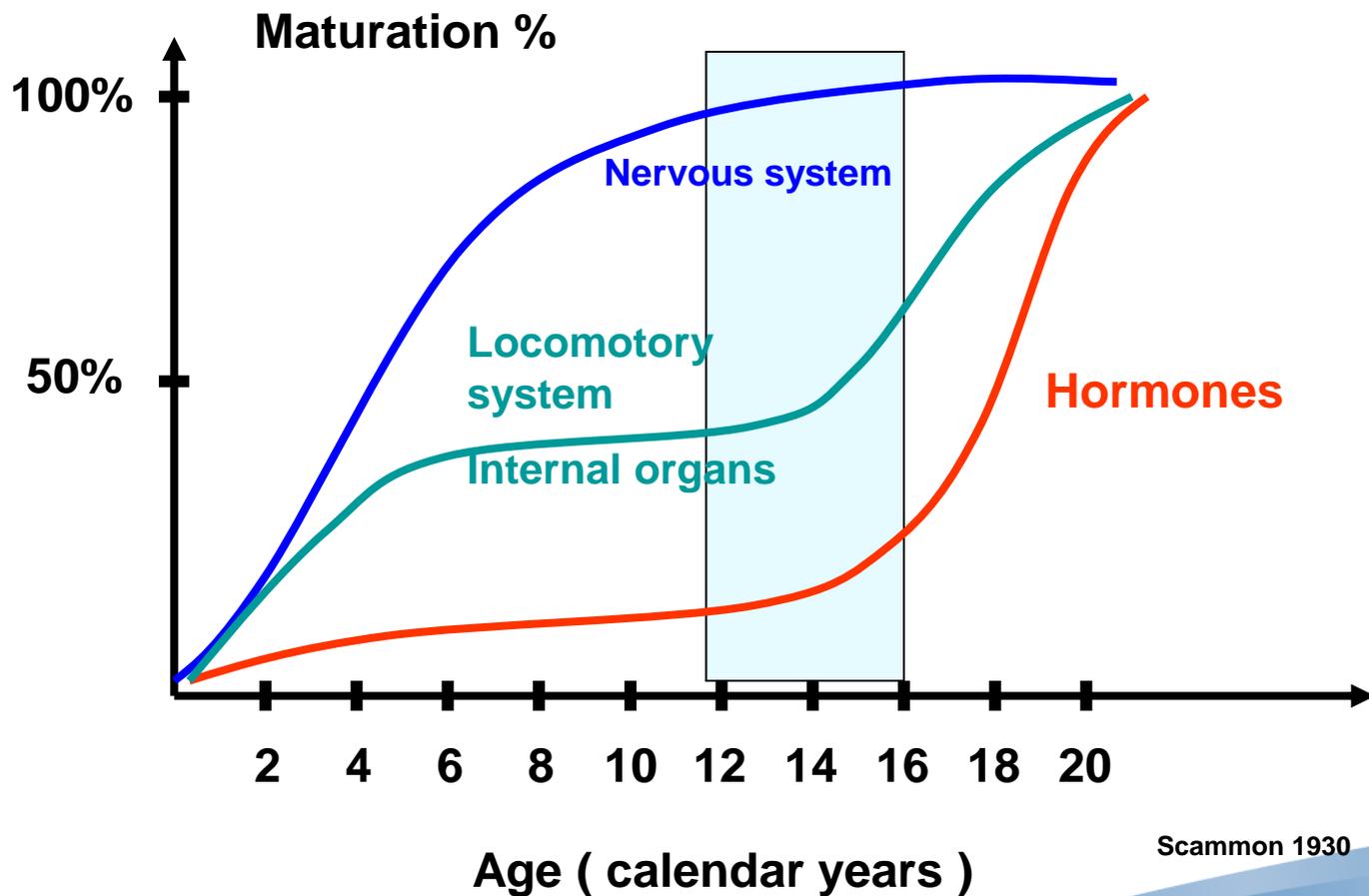
- IT IS POSSIBLE TO IMPROVE ALL LEVELS OF NEUROMUSCULAR SYSTEM, IF WE REMEMBER
 - To use various intensity = if you do always with 100%, you cannot control your muscles in slowly movements
 - jumps with 70, 80, 90, 100% intensity...
 - sprints with 70, 80, 90, 100% intensity...
 - To do thousands of repetitions = almost every day athletes should do nervous system training
 - 15-20 hrs of physical activity / week
 - > 15 min activity sessions
 - e.g. 15 min walk to school or practice and back = 30 min / day

2010



**WORLD
CHAMPIONSHIP
GERMANY**
Cologne - Mannheim
Gelsenkirchen

Biological maturation



Scammon 1930

2010

IIHF



WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Biological maturation of nervous system

- Nervous system grows very quickly during first 10 years of life
 - during that period is the most effective time for nervous system training = SPEED, COORDINATION AND AGILITY EVERY DAY
 - DONT CONCENTRATE TOO EARLY ON ONLY ONE SPORT
 - HOW IS IT IN YOUR CLUB OR COUNTRY ??
- Before and during growth spurt comes period when bones are growing very quickly which can cause motor control disturbances / problems
 - TRY TO MOTIVATE YOUR ATHLETES TO CONTINUE SPEED AND AGILITY TRAINING DURING THIS PERIOD
 - START TRAINING WITH FAMILIAR TRAININGS AND STEP BY STEP TRY TO DO MORE COMPLICATED EXERCISES - EXPLAIN THIS TO THE ATHLETE

2010



WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Biological maturation of nervous system

- DURING THE GROWTH SPURT PERIOD IT IS VERY IMPORTANT TO EXPLAIN TO THE ATHLETE, THAT NOW IT IS TIME FOR MAINTAIN YOUR SKILLS AND AFTER GROWTH SPURT HE/SHE CAN IMPROVE THEM AGAIN
 - highest drop out is in this age
 - are we selecting wrong types to ice hockey
- Growth spurt and motor control problems can occur in different calendar ages, because of different timing of biological maturation
 - DIFFERENCE CAN BE EVEN 3-4 YEARS, BUT TYPICALLY IT IS 2 YEARS
 - HOW IS YOUR TALENT SELECTION SYSTEM ?
 - DO YOU ONLY SELECT TALL, STRONG PLAYERS OR DO YOU SELECT ALSO BIOLOGICALLY LATE MATURATED PLAYERS, WHO CAN HAVE EVEN BETTER SKILL POTENTIAL?



WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Problems in western world among young athletes

- Basic motor control is not good enough / or too simply improved
- Basic endurance is not good enough = cannot repeat speed and agility exercises
- Core stability is not good enough = more injuries and balance is poor
- What is the reason?
 - Children don't have physical activity outside of the school or sport training
 - Time of individual Sport activity is less than 20-30 years ago
- In Finland we did study for 2800 sport juniors
 - training diary
 - training time / week
 - speed and skill and technique training time / week...

2010



WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Some results of Junior Athletes Study in Finland 2008

- Total physical activity decreases from ages 8-11 to over 12 years old juniors
- Physical activity in main sport increases in older groups
- Physical activity not in sport training (leisure time or individual training) decreases very dramatically after 11 years
- Skill (basic motor skills) training decreases in older groups
 - older than 12 yrs old juniors do mainly their "main sport"
- Technique (sport specific) training increases in older groups
- Junior athletes don't do speed or agility training alone as much as expected
 - almost always it needs own coach

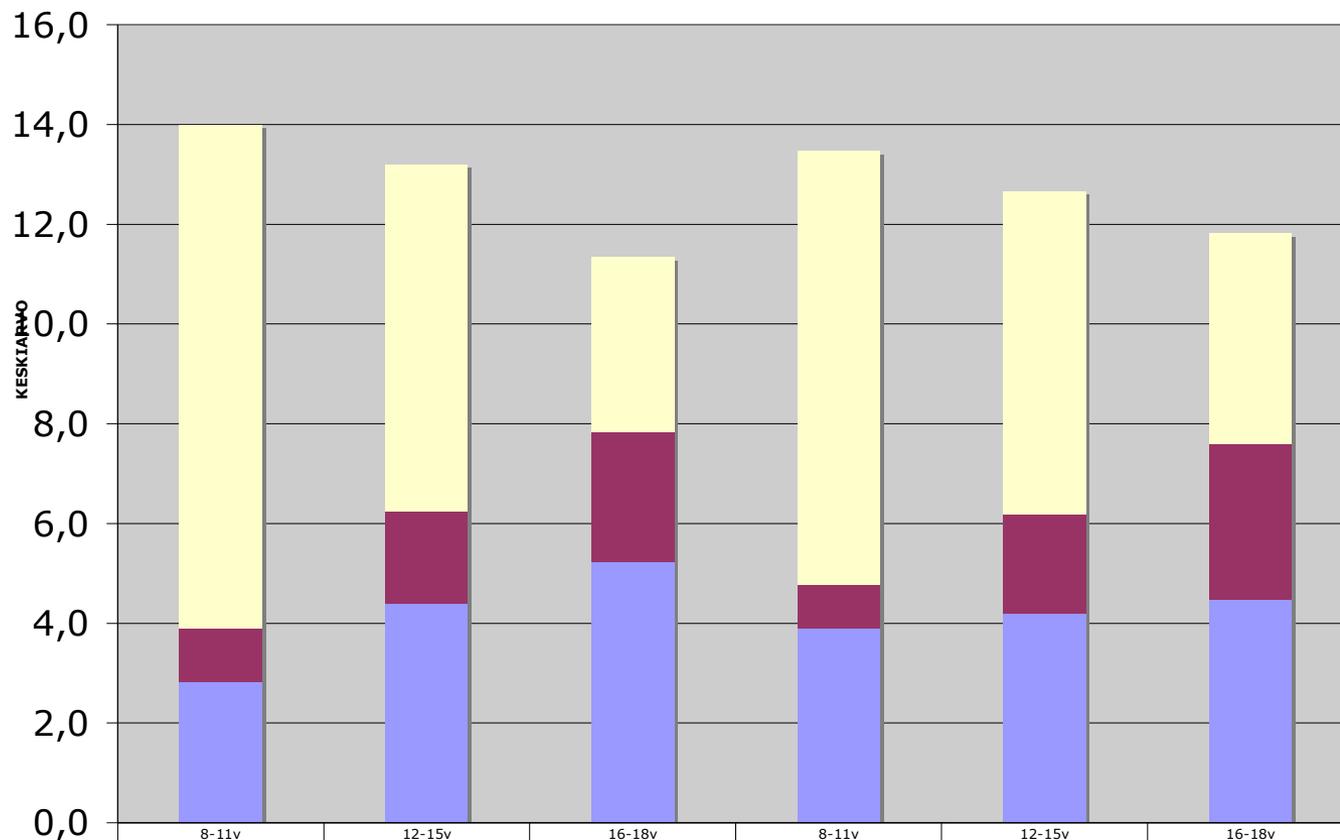
2010



WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Physical activity / week / In Finland

Physical activity Hours / week

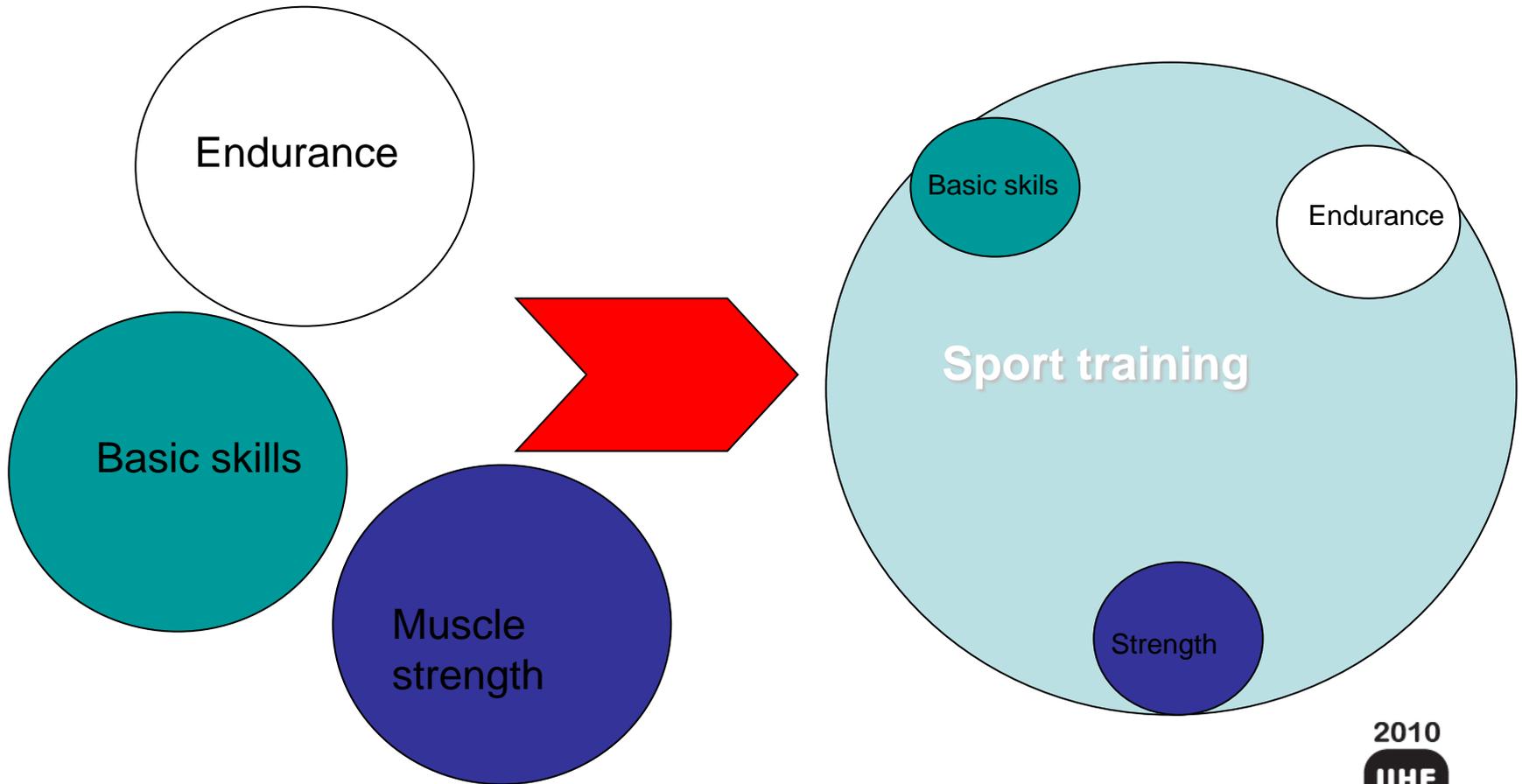


MUUT LIIKUNTATUNNIT - keskiarvo	10,1	6,9	3,5	8,7	6,5	4,2
PÄÄLAJIN OMATOIMISET HARJOITUSTUNNIT - keskiarvo	1,1	1,9	2,6	0,9	2,0	3,1
OHJATUT HARJOITUSTUNNIT - keskiarvo	2,8	4,4	5,2	3,9	4,2	4,5



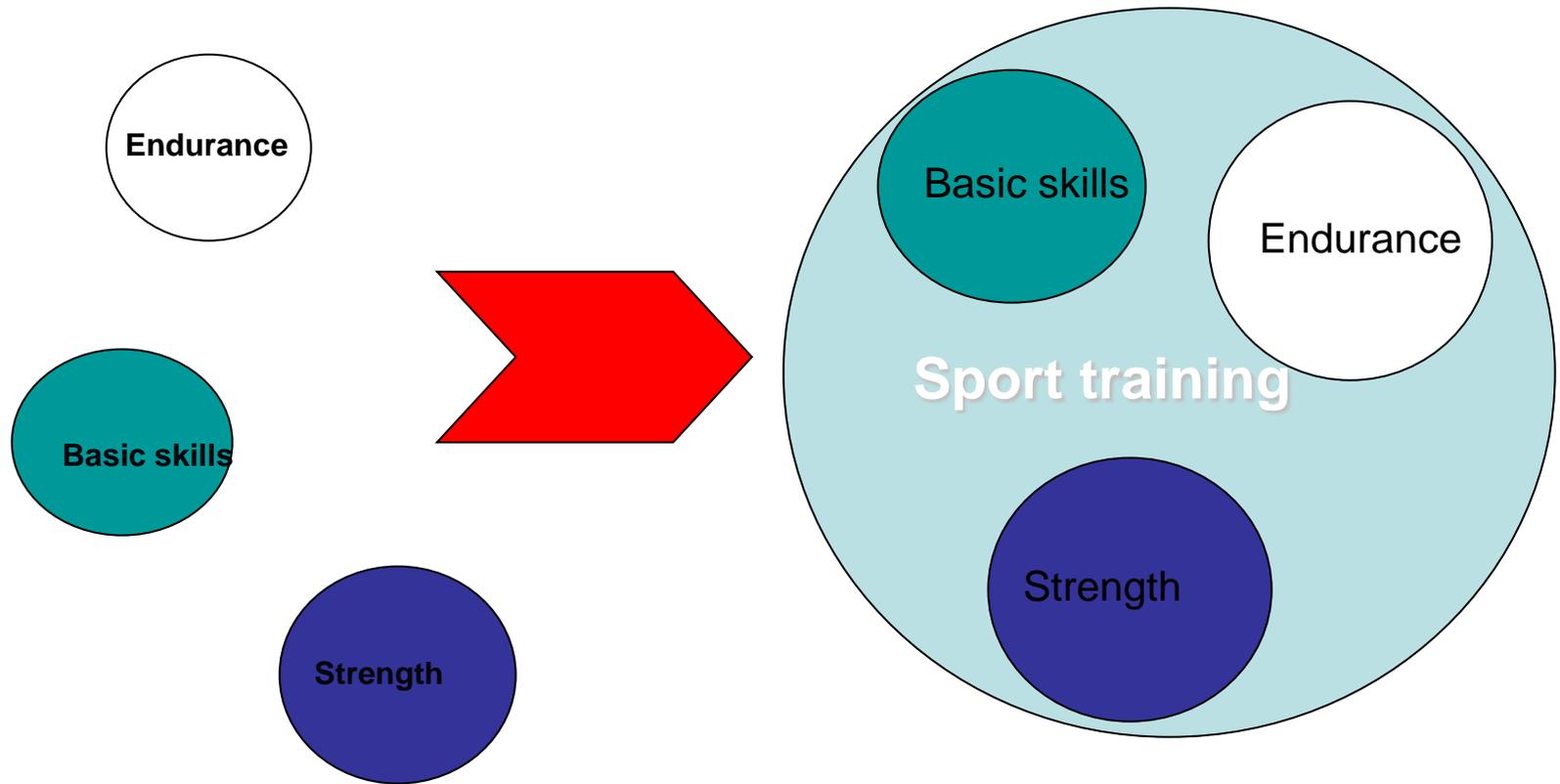
**WORLD
CHAMPIONSHIP
GERMANY**
Cologne - Mannheim
Gelsenkirchen

Sport coaching 20 years ago



WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Sport coaching today



2010



**WORLD
CHAMPIONSHIP
GERMANY**
Cologne - Mannheim
Gelsenkirchen

What to do?

- Education / knowledge for juniors, parents, PE-teachers and coaches
- Home tasks for juniors (muscle endurance, aerobic training, speed, motor skills, agility, core stability)
- Athletes have to come by walk or bike to training - get easily aerobic basic trainability
- Longer training sessions - warm ups and cool downs, which can be speed and agility or other type of nervous system training
 - warm up doesn't need to be running or bike - it can be muscle coordinations, agility, core stability = 10-15 min
 - cool down doesn't need to be running or bike - it can be muscle coordinations, agility, core stability = 10-15 min



WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Junior training = NERVOUS SYSTEM, MUSCLE ENDURANCE AND CARDIOVASCULAR TRAINING

- New stimulus
 - faster, better, longer, more power...
 - competitions
 - motivation
- In speed training not long sets
 - 2 - 15 seconds / set
 - AVOID NERVOUS SYSTEM FATIGUE AND HIGH ACCUMULATION OF LACTIC ACID BEFORE GROWTH SPURT, BUT AFTER THAT YOU DON'T NEED TO DO IT
- As much repetitions as possible to get structural adaptation of nervous system
 - how much is enough = ATHLETES CAN CONCENTRATE TO THE SAME EXERCISE
 - WHEN YOU SEE, THAT YOUR ATHLETES ARE TIRED, YOU CAN CHANGE EXERCISE, BUT ANYWAY CONTINUE THE TRAINING

Junior training = NERVOUS SYSTEM, MUSCLE ENDURANCE AND CARDIOVASCULAR TRAINING

- Every day
 - warm up > 15 min
 - before ice practice
 - cool down > 15 min
 - in separate of ice training sessions
- If you want to effectively improve neuromuscular system
 - 15-20 hours / week physical activity
 - collecting from short sessions and home tasks
 - nervous system training
 - after easy / rest day
 - in the beginning of the training
- IN SPEED EXERCISES RECOVERY TIMES ARE IMPORTANT
 - BEFORE GROWTH SPURT 20-40 SEC
 - AFTER GROWTH SPURT 2-3 MIN

2010



WORLD
CHAMPIONSHIP
GERMANY
Cologne - Mannheim
Gelsenkirchen

Examples

- **Speed + jumps**

- warm up coordination's 15 min
 - knees up + upper body totally relaxed 3x20m (forward, backward, sideward)
 - knees up + same arm / same leg 3x20m (forward, backward, sideward)
 - left knee up + right heel up 3x20m (forward, backward, sideward)
 - left heel up + right knee up + arms are rotating opposite directions 3x 20m (forward, backward, sideward)
- sprints over sticks or speed ladder with high frequency or rhythm:
 - 6x20 sticks or speed ladder as fast you can (take different ways - first right leg, then left, left-right-left-right.. /1 min recovery
 - 3x30m sprint forward / 90-95% intensity / walk back / 3 min recovery after series
 - 3x30m sprint backward / 90-95% intensity / walk back / 3 min recovery after series
 - 3x30m sprint right side ahead / 90-95% intensity / walk back / 3 min recovery after series
 - 3x30m sprint left side ahead / 90-95% intensity / walk back / 3 min recovery after series
- jumps uphill:
 - left-right-left-right 5x40m / walk back
 - skating jumps forward 5x40m / walk back
 - skating jumps backwards 5x40m / walk back
- aerobic cycling or jogging 10 min + muscle endurance by functional training 15 min



**WORLD
CHAMPIONSHIP
GERMANY**
Cologne - Mannheim
Gelsenkirchen

Example

- **Speed endurance + jumps**

- warm up coordination's 15 min
- basketball 15 min
- core stability 10 min
- sprints in stairs:
 - 4x8-10x30 steps sprint for every step / walk down / 3 min recovery between recovery
- easy jumps - intensity 75-80% :
 - left-right-left-right 5x60m / walk back / 3 min recovery
 - skating-jumps forward 5x60m / walk back / 3 min recovery
 - skating-jumps backward 5x60m / walk back / 3 min recovery
- football or basketball 30 min



**WORLD
CHAMPIONSHIP
GERMANY**
Cologne - Mannheim
Gelsenkirchen

Example week

- Mon Coordin/Agility + Ice + Core stability + at home aerobic endurance
- Tue Speed (off ice) + at home core stability
- Wed Coordin + Ice + Jumps + at home aerobic endurance
- Thu Individual Speed on Stairs
- Fri Coordin/Agility + Ice + Core stability
- Sat Individual speed endurance + jumps + balance
- Sun Rest

2010



**WORLD
CHAMPIONSHIP
GERMANY**
Cologne - Mannheim
Gelsenkirchen

Thank you!

2010

IIHF



**WORLD
CHAMPIONSHIP
GERMANY**
Cologne - Mannheim
Gelsenkirchen