UNIVERSITY OF PÉCS
MEDICAL SCHOOL

SPORTMED
PTE ÁOK SPORTMEDICINA TANSZÉK
Egy csapatban

Longterm athletes development model (LTAD)

Dorottya Szabó
Pécs University Medical School
Sport Medicine Center

23.03.2022. Pécs

Stages of growth

4 main stages (Mészáros-Mohácsi)

- Infancy and early childhood (0-3 ages) – fast growth
- Middle childhood (4-11 ages) – constant
- Puberty (12-15 ages) – growth spurs
- Postpuberty (16-20 ages) – slow down until adulthood

Longterm athlete development model (Balyi I., Lloyd & Oliver)

Different focus on each age group

- 0-6 ages
- 6-9 ages
- 9-12 ages
- **12-15 ages**
- 15-18 ages
- 18+

0-6 chronological age

- Elementary movement patterns
- Development of central nerve system
- Sports requiring early specialisation (gymnast, swimming)

6-9 chronological age

- intensive period of move-learning
- To introduce as many forms of movement as possible
- Development of general clever and co-ordination

Boys 9-12 age group- girls 8-11 age group

- First peak periog of movement development
- Significantly increase motor learning ability, learning new movements at an appropriate level
- Improves rythm of movement
- reduced side movements, efficient, more accurate movements
- Teaching sport-specific movements

Boys 12-16 age group - girls 11-15 age group

- Changes in body sizes, body proportion
- Changes in biomechanical conditions of movements
- temporary decline in some motor skills

Puberty

- Peak height velocity period

	averages		accelerated		late maturing	
	age	cm/year	age	cm/year	age	cm/year
Boys	13,4	8,6	11,6	9,4	15	7,9
girls	11,2	8,32	9,8	9,01	12,8	7,61

13 14 13 14

Biological age and PHV

- the timing and pace of biological maturation may vary
- One way of characterising is PHV
- If we do not know the biological age of the child → leads to misinterpretation of physical tests and more frequent selection of accelerated children
- Measuring possibilities:
    - Based on X-ray (gold standard)
    - Secondary sex characteristics
    - Morphological age – monitoring changes in body sizes

Biological age and PHV

Estimating formula of PHV:

- Mirwald (2002) 152 persons (79 boys,73 girls) – over- and underestimates for accelerated and late maturing children, accuracy ± 1 year
- Koziel és Malina revised, but the accuracy could not be improved
- Moore - works well for average maturity, accuracy ± 1 year
- Fransen formula – maturity ratio=chronological age/biological age → prePHV < 1 < postPHV
  (designed for boys only, less accurate below the age of 11)
- CONTINUOUS, LONGTERM MONITORING

Biological age and PHV

Khamis- Roche method

- Estimated adult height

  85 %prepuberty, 85-90 %early puberty, 90-95 %middle puberty (PHV), 95 %postpuberty
- Premier League – elite Player Performance Plan
- Biobending trainings

Biological maturity and performance

- Phillippaerts et al.– 1.balance, explosiveness, speed, agility increase around PHV greatest 2. flexibility after PHV 3. skeletal muscle formation is completed after PHV
- Doncaster et al.– PHV around improved aerobic endurance

PHV and injury risk

- Adolescents have a higher risk of injury
- U14 and U15 have the most injuries (average 132-143 injuries/year, 219 days missed)
- 78 %lower limb, 45-72 %non-contact → PREVENTION !!
- The most common injuries in U12-U14 are gradual injuries (Schlatter, Sever)
- Injury risk increases in the 6 months after PHV
- Growth during PHV 7-12 cm/year - motor coordination deficit
    - Musculo-skeletal system cannot keep up with longitudinal growth - joint stability – PROPRIOCEPTION
    - Higher load on the lower limb – STRENGTHENING
    - Improving mobility efficiency – STRETCHING
    - Reducing sudden breaking, sudden changes of direction

- Monthly height increase > 0.6 cm → 1.63x injury risk (Kemper et al.)
- Dosage of training load ??

Relative age effect

- For junior national teams, the number born at the beginning of the year is over-represented2010-11 labdarúgó
- Football Youth national team (2010-11 age group) Q1 40 %, Q2 30 %, Q3 20 %, Q4 10 % → born in Q4 have ¼ chance
- RAE effect strongest in adolescence
- In sports where physical characteristics play a major role
- Actual performance or potential in future ???
- RAE + biological maturity

  January-December → 6,1 cm, 3,9 kg

  accelerated- postmatured → **16,5 cm, 16 kg**

Boys 16-23+ age group - girls 15-21+ age group

- stabilisation
- Development of individual movement patterns

Fiúk 19+/-, lányok 18+/-

- *Maximalize body and performance*

Aim of LTAD

Healthy and Lifelong Physical Activity

Problems in practice

- Underutilisation of sensitive periods in the development of skills/abilities
- Opposition between calendar and biological age (maturity) dominates training and competition up to 11-16 years (Relative Age Effect)
- The "impairment" of 6-10 and 10-16 year olds is not fully correctable (athletes do not reach their genetic potential)
- Development of general motor skills/skills usually starts late (from age 11 for girls and 12 for boys)
- Parents,coaches are not trained in the long-term preparation of athletes (nutrition, recovery, maturational characteristics and psychosocial development, etc.)
- Problems of coordination between sports science, sports medicine and sport-specific technical-tactical activities (training, competitions)

UNIVERSITY OF PÉCS
MEDICAL SCHOOL

Thanks for attention!

23.03.2022 Pécs