

# Adolescence Physiology in Sport

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# How to be a world top athlete?

- Natural ability
- Favorable environmental conditions

Competitive sports offer a wide range of **challenges** that athletes must overcome in order to succeed and excel

Physical

Strategic

Mental

Emotional

# What do athletes need?

Character

Connection

Confidence

Competence



**The coaches' responsibility**

# Top challenges

- Initial selection- Who will be the next Ronaldo?
- Optimal athlete development

➤ Less is known about those who are systematically excluded, who drop out or are injured

During adolescence face **physiological challenges** as their bodies undergo significant growth, development, and hormonal changes

**These challenges can impact young athlete performance,  
training, and overall well-being**



# Performance on the field

**Sport performance** progressively improves with growth and maturation

# Puberty variations in sport

- **Variations in the timing of puberty can affect an athlete's performance relative to their peers**

# Maturation

- **Maturity status-** the status of the youngster at the time of observation
- Maturity status is specified by skeletal age (SA) and secondary sex characteristics
- **Maturity timing-** refers to the chronological ages when specific maturational events occur

# Skeletal age (SA)

- SA is a useful estimate of **maturity status**
- SA use for chronological age verification

## Males

SMR	Pubic Hair
Stage 1	Preadolescent
Stage 2	Scanty, long, slightly pigmented, primarily at base of penis
Stage 3	Darker, coarser, starts to curl, small amount
Stage 4	Coarse, curly; resembles adult type but covers smaller area
Stage 5	Adult quantity and distribution, spread to medial surface of thighs

# Male-Sexual Maturity Ratings (SMR)

SMR	Penis	Testes
Stage 1	Preadolescent	Preadolescent
Stage 2	Slight or no enlargement	Beginning enlargement of testes and scrotum; scrotal skin reddened, texture altered
Stage 3	Longer	Further enlargement of testes and scrotum
Stage 4	Larger in breadth, glans penis develops	Testes and scrotum nearly adult
Stage 5	Adult	Adult

# Females

## SMR

## Pubic Hair

Stage 1	Preadolescent
Stage 2	Sparse, slightly pigmented, straight, at medial border of labia
Stage 3	Darker, beginning to curl, increased amount
Stage 4	Coarse, curly, abundant, but amount less than in adult
Stage 5	Adult feminine triangle, spread to medial surface of thighs

# Female-Sexual Maturity Ratings (SMR)

## SMR

## Breasts

Stage 1	Preadolescent; elevation of papilla only
Stage 2	Breast and papilla elevated as small mound; areola diameter increased
Stage 3	Breast and areola enlarged with no separation of their contours
Stage 4	Projection of areola and papilla to form secondary mound above the level of the breast
Stage 5	Mature; projection of papilla only, areola has recessed to the general contour of the breast

# Brain maturation

- Frontal lobe maturation
- Better judgment, impulse control, long term planning and emotional control

# Brain maturation

- Increased **myelinogenesis**
- The brain is influenced by heredity, environment, sex hormones (estrogen, progesterone, and testosterone), food, and sleep habits



# Age criteria for qualifying children and adolescents for participation in sports

- Humans experience maturation differently
- Females tend to mature faster than boys
- Post-pubertal boys will experience greater increases in strength and power due to testosterone and other androgen hormones

# Success of athlete development

- The model of athlete development is built on an **individually unique** and constantly **changing base**

# Coaching education and effectiveness

- It is essential that coaches understand **physical growth**,  
biological **maturation** and **behavioral development**

# Coache's knowledge

- sport-specific content
- pediatric exercise science
- pedagogical knowledge
- injury prevention

# Age criteria for qualifying children and adolescents for participation in sports

- Individual differences in growth and maturation can lead to unforeseen consequences in competitive sports
- **Bio-banding-** involves grouping athletes based on size and/or maturity status rather than chronological age

# Talented athletes- programs qualification

- Selection/exclusion process commonly occurring between 9 and 15 years of age
- Assessments indicate stage of puberty at the **time of observation**, but provide no information on other variables (timing and tempo of growth and maturation)

# Assessment of biological maturity status and timing

- Sport selection favoring early maturing males in many sports increase the likelihood of false negatives

# Qualifying for participation in sports

- Currently athletes begin **specialized training** at an increasingly younger age
- This may be due to greater pressure for achievement from coaches or parents



# Should participation during childhood and adolescence be specialized or diversified?

# What is better?

- Does a focus on intensive specialized practice facilitate excellence?
- Is a more diversified background better?

## Meta-analysis in a sample of 6,096 athletes (Gullich, 2021)

- What explains the acquisition of exceptional human performance?
- Compared World/National, Senior/junior athletes

# Main points

- The **amount of multisport practice** is critical in discriminating adult world-class athletes and their national-class counterparts
- **Senior world-class** performers:
  - Engaged in **more** coach-led practice in other sport during childhood/adolescence
  - Began playing their main sport **later**
  - Accumulated **less** main-sport practice
  - Reached performance milestones at a **slower** rate than national-class performers
- Senior world-class athletes who began their main sport early and specialized are the exception, not the rule

# Main points

- Better junior-age performers:
  - Started main-sport practice **earlier**
  - Accumulated **more** childhood/adolescent main-sport practice
  - Accumulated **less** other-sports practice
  - Reached performance milestones at a **faster rate** than did their lower performing counterparts
  - Youth-led play in one's main sport and in other sports had **negligible effects** on both junior and senior performance

**Sports organizations make a choice, which may or may not be conscious**

**Reinforce rapid junior success at the expense of long-term senior success**

**Facilitate the long-term development of senior performance at the expense of early junior performance**

# Suggested explanations

- **Sustainability hypothesis:** Childhood/adolescent participation in multiple sports is associated with a lower risk of later overuse injury and burnout
- **Multiple-sampling and functional matching hypothesis:** The focus on one main sport emerges from an athlete's experiences in multiple sports, which increases the odds that an athlete will select a sport at which he or she is particularly talented
- **Transfer as preparation for-future learning (PFL) hypothesis:** More varied earlier learning experiences facilitate later long-term domain-specific skill learning and refinement

# International Olympic Committee consensus statement on youth athletic development (2015)

- Research suggests that youth should avoid early sport specialization
- Diverse athletic exposure and sport sampling enhance:
  - motor development and athletic capacity
  - reduce injury risk
  - increase the opportunity for a child to discover the sport(s) that he/she will enjoy and possibly excel



Evidence indicating that children who participate in a variety of sports and specialize only after reaching the age of puberty, for example, tend to be **more consistent performers**, have **fewer injuries** and **adhere to sports play longer** than those who specialize early

**The End**