Bio-Age.eu

Introduction to the Bio-Age Approach in Youth Football Training

Breaking Barriers and Promoting Equity in Youth Football: Using Bio-Age to Foster Inclusivity

Co-funded by the European Union

ERASMUS-SPORT-2023-SSCP
Project No 101134174

Table of Contents

1. Introduction 4
2. Understanding Bio-Age and Bio-Banding 5
    a. Difference between Bio-Age and Bio-Banding
    b. Why Bio-Age Matters in Youth Football Training
3. Key Concepts in Biological Maturation 6
4. Assessing Biological Age 8
5. Guidelines for Implementing the Bio-Age Approach 12
6. Conclusion 14
7. References 15

Co-funded by the European Union

ERASMUS-SPORT-2023-SSCP
Project No 101134174

Bio-Age.eu

This guidebook was developed as part of the Erasmus+ Sport Project titled **"Breaking Barriers and Promoting Equity in Youth Football: Using Bio-Age to Foster Inclusivity".**

The project's primary aim is to promote equal opportunities for all young football players, especially late bloomers, by addressing training systems that do not fully accommodate each player's development needs.

This initiative seeks to improve the quality of coaching and sports staff through sustainable, player-centered youth development programs focused on the bio-age approach.

The project also promotes interdisciplinary collaboration between football clubs and sports science departments to foster inclusivity and equity in youth football.

This guide represents one of the tools in achieving these objectives by introducing coaches to the bio-age approach.

Disclaimer:
Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

ERASMUS-SPORT-2023-SSCP
Project No 101134174

1. Introduction

Football, the world's most popular ball game, offers an unparalleled entry point for young athletes to develop skills, resilience, and teamwork. Many professional clubs invest in youth Academies to train young players for eventual progression to senior teams, focusing on player development as a means to nurture in-house talent. While many young players dream of becoming football stars, each child develops at a unique rate—some are early bloomers with noticeable physical advantages, while others are late bloomers who may not reach their full athletic potential until later.

Unfortunately, traditional chronological age-grouping in youth sports tends to favor early maturers, creating barriers for late bloomers, particularly in gaining coaching attention and playing time.

This guidebook introduces coaches to the Bio-Age Approach, a method that promotes equitable player development by grouping athletes according to their biological age (bio-age) rather than strictly by chronological age. Known as bio-banding, this approach fosters a more balanced, inclusive, and developmentally appropriate training environment that helps nurture each player's potential, regardless of when they reach physical maturity.

With an emphasis on the principles of bio-age and bio-banding, this guide explains core concepts of biological maturation and provides actionable steps for coaches to implement bio-banding practices. The Bio-Age Approach ultimately supports safe, competitive, and inclusive player development, promoting opportunities for every athlete to thrive.

2. Understanding Bio-Age

Difference between Bio-Age and Bio-Banding

Bio-Age, short for biological age, refers to an individual's level of biological development, which may differ from their chronological age (the actual number of years since birth). Biological age is typically assessed based on physical and physiological characteristics such as growth, development, and maturity, which can vary greatly between individuals of the same chronological age.

Bio-Banding is a concept used in sports, where athletes are grouped based on their biological age rather than their chronological age. This method is used to ensure fair competition, better development, and reduced injury risks, as athletes mature at different rates. Bio-banding allows for grouping young athletes by their maturity levels, focusing on physical development rather than age alone.

In the context of bio-banding, biological age (bio-age) is a critical criterion for grouping athletes. Unlike chronological age, which simply reflects the number of years since birth, biological age provides insight into an athlete's maturity level, including physical and physiological development. Bio-banding is a practice that uses biological age as a guiding factor to group athletes into categories more aligned with their physical maturity.

While bio-age is essential to the bio-banding process, the two terms are not synonymous. Bio-banding refers specifically to the method or practice of creating these developmentally appropriate groups, whereas bio-age is one of the key indicators used to determine where an athlete fits within these groups.

Thus, bio-age is a foundational measure that makes bio-banding possible but is not equivalent to bio-banding itself.

Why Bio-Age Matters in Youth Football Training

Football is a sport that demands a combination of technical skills, tactical awareness, and physical attributes such as speed, strength, and endurance. The traditional method of age-grouping based on chronological age often leads to mismatches in physical ability, as players who mature earlier gain a physical advantage over those who mature later.

These mismatches can result in:

1. **Unfair competition:** Early maturing players may dominate games simply because of their physical size and strength, not necessarily due to superior skill.
2. **Injury risks:** Players who are less physically developed may be at a higher risk of injury when competing against stronger, faster peers.
3. **Uneven skill development:** Late-maturing players may struggle to develop their skills properly if they are constantly physically outmatched.

3. Key Concepts in Biological Maturation

Biological maturation refers to the physical and physiological development individuals undergo from infancy to adulthood. Unlike chronological age, which counts the number of years since birth, biological maturation reflects the actual developmental progress of the body. This process is influenced by a combination of genetic, hormonal, and environmental factors, and it varies significantly between individuals

Key aspects of biological maturation includes:

Growth
This involves increases in body size and mass, particularly height, weight, and skeletal structure. Growth rates differ between individuals and are most pronounced during specific periods, such as puberty.

Puberty
During puberty, individuals experience sexual development and secondary sexual characteristics, such as breast development in females or facial hair in males. The onset and progression of puberty vary widely, further contributing to differences in biological age.

Hormonal Changes
Fluctuations in hormones, such as the increased production of sex hormones like estrogen and testosterone, drive many of the changes associated with biological maturation. Hormonal changes also impact muscle growth and the development of other bodily systems.

Muscle and Skeletal Development
As individuals mature, they gain muscle mass, strength, and bone density. These changes influence overall physical capabilities, such as speed, agility, and coordination, which are crucial in football.

Understanding these elements helps coaches evaluate each player's development and apply bio-banding principles effectively.

4. Assessing Biological Age

One of the most effective methods to assess an athlete's biological age is to estimate their **Predicted Adult Height (PAH)**.

Developed by Dr. Harry Khamis and Dr. Alex Roche, this method is considered one of the most accurate ways to predict adult height, especially when the child is five or older. It takes into account children's natural growth patterns and the genetic influence of parents' height.

This formula estimates the future height of a player based on:

- The current height and weight of the player,
- The age of the player,
- The heights of their biological parents.

Here are links to the resources with detailed instructions on how to correctly measure standing height and weight and to the Khamis-Roche Method online calculator for estimating Predicted Adult Height (PAH)

- **Measuring Standing Height**
  https://tiny.pl/w1c9wyg8
- **Measuring Body Mass**
  https://tiny.pl/qm_gyp3r
- **Online PAH calculator**
  https://tiny.pl/8129n3tq

These arbitrary maturity categories are:

1. **Pre-pubertal (<85% of PAH)**
2. **Early pubertal (>85-90% of PAH)**
3. **Mid-pubertal (90-95% of PAH)**
4. **Late pubertal (>95% of PAH)**

Here are recommended guidelines for training young athletes according to their Predicted Adult Height (PAH) categories, from pre-pubertal through late pubertal stages. These guidelines consider physiological development, risk of injury, and the types of skills and training focus suitable for each maturity stage.

1 Pre-Pubertal (<85% of PAH)

Characteristics:

- Younger, before significant growth spurts.
- Lower muscle mass and endurance, with developing motor skills.

Recommended Training Focus:

- **Skill Development** - emphasize fundamental movement skills (e.g., agility, balance, coordination) and basic technical skills in football (e.g., dribbling, passing).
- **Low-Intensity Conditioning** - use light aerobic activities to build general fitness without heavy focus on strength.
- **Fun and Engagement** - keep sessions enjoyable and varied to foster a love for the sport.
- **Injury Prevention** - minimize high-impact activities; flexibility exercises can help improve mobility.

Training Load:

- **Frequency** - 2-3 times per week.
- **Duration** - short sessions (30–45 minutes), focusing on skill repetition rather than intensity.

2 Early Pubertal (85-90% of PAH)

Characteristics:

- Initial signs of growth spurts, early stages of puberty.
- Increased neuromuscular coordination and interest in sport-specific skills.

Recommended Training Focus:

- **Skill Refinement** - continue developing technical skills with increased complexity.
- **Basic Strength Training:**- begin introducing bodyweight exercises to improve core strength and stability, focusing on form.
- **Endurance and Aerobic Conditioning** - light aerobic activities with gradual increases in duration and intensity.
- **Flexibility and Mobility**- stretching exercises, especially as growth increases tension in muscles and tendons.
- **Injury Awareness** - monitor for signs of overuse or joint strain, as growth spurts may increase susceptibility to injuries.

Training Load:

- **Frequency** - 2-3 times per week.
- **Duration** - short sessions (30–45 minutes), focusing on skill repetition rather than intensity.

3 Mid-Pubertal (90-95% of PAH)

Characteristics:

- Accelerated growth; more defined muscle development and increased strength potential.
- Greater anaerobic capacity and enhanced focus on competition.

Recommended Training Focus:

- **Advanced Skill Development** - emphasize tactical skills, decision-making, and sport-specific drills.
- **Strength and Power Training** - controlled introduction of resistance training with low weights and high repetitions to build endurance and strength.
- **Speed and Agility Drills** - short sprints, plyometrics, and agility exercises, focusing on controlled movement to improve coordination.
- **Aerobic and Anaerobic Conditioning** - increase the intensity and duration of aerobic exercises, incorporating interval training.
- **Injury Prevention** - continue flexibility exercises and add proprioceptive drills to support joint stability.

Training Load:

- **Frequency** - 4–5 times per week.
- **Duration** - longer sessions (60–75 minutes), with a focus on a balance of skill, strength, and conditioning

4 Late Pubertal (>95% of PAH)

Characteristics:

- Approaching final adult height and physical maturity.
- Greater ability to handle physical training loads similar to adult levels.

Recommended Training Focus:

- **Sport-Specific Skill Specialization** - intensive practice of advanced tactics and complex skills relevant to their position or role in the sport.
- **Strength, Power, and Speed Training** - comprehensive strength training, incorporating moderate weights and increased intensity for power.

- **High-Intensity Conditioning** - incorporate interval and circuit training to enhance endurance and agility.
- **Recovery Protocols** - integrate proper rest, stretching, and recovery sessions to manage training loads and reduce injury risk.
- **Mental Conditioning** - begin incorporating psychological training, focusing on concentration, resilience, and competitive mindset.

Training Load:

- **Frequency** - 5–6 times per week.
- **Duration** - extended sessions (75–90 minutes), simulating the demands of higher-level competition.

General Notes for Coaches

- **Regular Monitoring** - growth spurts and rapid physical changes require ongoing adjustments to training plans. Regularly monitor players for signs of fatigue or injury.
- **Customized Training** - each athlete's response to training may vary, so consider individual adjustments within each PAH category.
- **Education on Injury Prevention** - ensure athletes are aware of the importance of warm-ups, cool-downs, and stretching as part of their injury prevention strategy.

5. Guidelines for Implementing the Bio-Age Approach

Assess Biological Maturity Regularly.
Coaches should regularly assess their players' biological age using PAH predictions. This allows for accurate bio-banding and ensures players are grouped according to their physical maturity levels, reducing the risk of mismatched competition.

Tailor Training Programs to Maturity Levels
Biological maturity should guide training intensity and focus. For example, early maturers may benefit from strength and power training, while late bloomers may need to focus more on technical and tactical skills to keep up with physically larger peers. Programs should be flexible and adapt as players mature.

Promote Fair Competition
Organize training and matches that group players with similar levels of biological development. This ensures balanced competition, allowing late bloomers to develop their skills without being overshadowed by physically dominant peers.

Monitor Growth and Adapt Strategies
Keep track of players' growth patterns and make adjustments as needed. Rapid growth spurts can affect coordination and increase injury risks. Coaches should adapt training loads to minimize injury and provide support during these periods of rapid change.

Educate Players and Parents
Both players and their parents need to understand the principles behind bio-banding and bio-age assessments. Educating them about the importance of development over time, rather than short-term success, can reduce anxiety and build confidence in late bloomers.

Create a Supportive Environment:
Psychological and emotional support is key, especially for late-maturing players who may face self-esteem issues. Coaches should create an environment where all players feel valued and encouraged to develop at their own pace.

6. Conclusion

The Bio-Age Approach in youth football training marks a progressive step towards creating more equitable and developmentally appropriate environments for young athletes.

By focusing on biological age and implementing bio-banding strategies, coaches can ensure that all players, regardless of their stage of maturation, have the opportunity to succeed, develop their skills, and enjoy the sport.

This approach not only improves player performance but also promotes long-term well-being and reduces the risk of injuries

Bio-Age.eu

Co-funded by
the European Union

7. References

General Concepts in Bio-Banding and Biological Maturation:

- Cumming, S. P., Lloyd, R. S., Oliver, J. L., Eisenmann, J. C., & Malina, R. M. (2017). Bio-banding in sport: Applications to competition, talent identification, and strength and conditioning of youth athletes. Strength & Conditioning Journal, 39(2), 34-47.
- Malina, R. M., Rogol, A. D., Cumming, S. P., Coelho e Silva, M. J., & Figueiredo, A. J. (2015). Biological maturation of youth athletes: Assessment and implications. British Journal of Sports Medicine, 49(13), 852-859.

Bio-Age Approach for Equitable Development:

- Till, K., & Baker, J. (2020). Challenges and opportunities in the development of youth athletes: Perspectives on talent identification and athlete development. Frontiers in Psychology, 11, 1386.
- Football New South Wales. (2021). Football Development Resources [YouTube Channel]. Provides instructional videos, including measurement techniques. Available at: YouTube: Football NSW(BIO-AGE)

Khamis-Roche Method and Measurement Tools:

- Khamis-Roche Method Calculator for PAH: Calculator Academy offers an online tool based on the Khamis-Roche Method for predicting adult height, specifically designed for sports applications. Available at: Calculator Academy(BIO-AGE)

Assessment of Biological Age and Training Load Guidelines:

- Meylan, C., Cronin, J., Oliver, J., & Hughes, M. (2014). Talent identification in soccer: The role of maturity status on physical, physiological, and technical characteristics. International Journal of Sports Science & Coaching, 9(4), 651-667.
- Malina, R. M., & Bouchard, C. (1991). Growth, maturation, and physical activity. Human Kinetics. This book offers an in-depth look at how physical growth and biological age impact athletic performance in young athletes.

Developing Player-Centered, Bio-Banding-Based Programs:

- Lloyd, R. S., Oliver, J. L., Faigenbaum, A. D., Howard, R., De Ste Croix, M. B., Williams, C. A., & Myer, G. D. (2015). Long-term athletic development- Part 2: Barriers to success and potential solutions. Journal of Strength and Conditioning Research, 29(5), 1451-1464.

Bio-Age.eu

Introduction to the Bio-Age Approach in Youth Football Training

Breaking Barriers and Promoting Equity in Youth Football: Using Bio-Age to Foster Inclusivity

Co-funded by the European Union

ERASMUS-SPORT-2023-SSCP
Project No 101134174