

Research on Youth Physical Development in China from a Long-Term Athlete Development Perspective

Qili Liu

Beijing Sport University, Beijing, 100084, China

ABSTRACT

This study examines youth physical development in China from a Long-Term Athlete Development (LTAD) perspective. Chinese research has increasingly moved from short-term performance concerns toward a development-oriented framework that emphasizes stage-appropriate goals, fundamental movement skills, general physical qualities, and the gradual integration of sport-specific training. However, this conceptual progress has not been matched by equally strong implementation. Persistent problems include short-term evaluation, early sport specialization, adult-oriented training practices, fragmented foundational training, and weak links between athlete monitoring and training prescription. This study argues that the central challenge in youth physical development in China is no longer the absence of a developmental framework, but the limited translation of that framework into stable, evidence-informed, and context-sensitive practice.

KEYWORDS

Long-term athlete development; Youth physical development; Fundamental movement skills; Athlete monitoring; Sport specialization; China

1 Introduction

Youth physical development has become a central issue in both competitive sport and school-based physical education in China. As concerns over declining physical fitness, sport injury risk, and the scientific preparation of reserve talent continue to grow, the need for developmentally appropriate training has become increasingly urgent. In this context, the Long-Term Athlete Development (LTAD) framework provides a useful lens for understanding how training, competition, and recovery should be aligned with the changing developmental characteristics of children and adolescents. Although LTAD has gained increasing influence in Chinese research, important questions remain regarding how its principles are translated into practical training design, evaluation, and monitoring. This study therefore reviews the current state of youth physical development in China from an LTAD perspective, with particular attention to conceptual progress, persistent practical problems, and future directions for improvement.

It must be emphasized that children and adolescents are not simply scaled-down adults. Young people differ substantially from adults in morphological and functional development, neuromuscular control, and psychological and social development, and these differences mean that youth physical development follows its own logic in terms of training philosophy, content structure, methods, load arrangement, and recovery. If the laws of growth and development are ignored and adult training ideas are applied mechanically, problems such as short-term and overly narrow training goals, premature specialization, adult-oriented training, imbalances between load and recovery, and the absence of monitoring and evaluation are likely to occur. These problems may in turn increase fatigue and injury risk, weaken the development of fundamental athletic abilities and the quality of technical learning, and ultimately constrain long-term talent development pathways. The LTAD framework emphasizes the whole-process planning of training participation, competition, and recovery on the basis of individual developmental patterns.

The LTAD framework emphasizes the whole-process planning of training participation, competition, and recovery on the basis of individual developmental patterns. It therefore provides a systematic theoretical tool for youth physical development as well as a basis for risk control. From this perspective, reviewing research progress and practical problems in youth physical development in China and proposing actionable recommendations is of clear significance for improving the scientific level of training and the quality of reserve talent cultivation.

2 Related Concepts

2.1 LTAD model

Long-Term Athlete Development (LTAD), proposed by Istvan Balyi, is widely understood as a lifespan model of whole-person development. It emphasizes long-term planning based on the stage-specific physiological, psychological, and emotional characteristics of young people and integrates sport participation, training, competition, and recovery. As stated in the original LTAD text, long-term athlete development is “a pathway of training, competition, and recovery that

guides an individual's experience in sport and physical activity" (Sport for Life, 2017). The same source further stresses that training, competition, and recovery programmes should be based on developmental stage rather than chronological age (Sport for Life, 2017).

2.2 Comparison between LTAD and YPD

Although LTAD provides a macro-level framework for youth development, its guidance on training implementation and physical development remains limited. The Youth Physical Development (YPD) model addresses this issue by emphasizing the integrated development of physical qualities throughout childhood and adolescence and by offering more concrete guidance for practice. Accordingly, some Chinese studies have explored an approach in which LTAD provides the macro framework and YPD offers micro-level support. One study argues that a rigidly mechanical mode of stage classification has obvious theoretical limitations (Tao et al., 2019). Another notes that the YPD model follows growth and development, highlights integration among training elements, and adopts multidimensional monitoring and evaluation (Ma, 2025).

2.3 Overview of Youth Physical Development

Existing studies generally describe youth physical development in terms of morphology, function, and physical qualities, including speed, strength, endurance, flexibility, agility, and coordination, as well as sport-specific physical qualities. Research in this field serves both health promotion and reserve talent development for competitive sport. As one source notes, compared with traditional exercise interventions, physical development is more systematic, comprehensive, and better structured (Zong et al., 2025).

3 Results and Analysis

3.1 Current State of Youth Physical Development in China from an LTAD Perspective

A review of domestic and international studies suggests that Chinese research on youth physical development has gradually formed an LTAD-oriented framework. This framework emphasizes long-term development, stage appropriateness, and the coordination of physical preparation with technical learning, competition participation, and recovery management. Although consensus at the conceptual level has become clearer, evidence on programme specification and practical validation remains limited. This indicates that the field has advanced more rapidly in framework construction than in operational guidance.

3.1.1 Training Goals Have Shifted Toward Long-term Stage-based Development

Chinese studies increasingly define LTAD as a framework for the continuous development of youth athletic ability and stress that training goals should match stages of physical and psychological development. Research on triathlon regards LTAD as a scientific and periodized system for long-term youth development and suggests that biological age and stage characteristics should guide programme design (Bian, 2020). Tennis research similarly draws on the "10-year rule" to argue that high-level performance depends on long-term accumulation rather than short-term rankings (Bi, 2019). LTAD 2.1 further states that short-term performance goals should not undermine long-term athlete development (Sport for Life, 2017). Together, these studies show a clear shift from immediate performance targets toward developmentally appropriate planning.

3.1.2 Foundational Training is Increasingly Emphasized

Another major trend is the recognition that early-stage training should focus on movement competence and general physical qualities before progressing toward sport-specific physical qualities. Research on long-term swimmer development identifies childhood and adolescence as critical periods for the development of fundamental movements and athletic qualities (Zhang et al., 2018). Research on triathlon likewise emphasizes that movement is central to physical training and that programme design should connect movement quality, movement patterns, and sport-specific demands (Bian, 2020). Sport-specific studies further show that Chinese research has moved from recognizing the value of the foundation to discussing how it should be organized and transferred into sport-specific preparation (Bi, 2019; Gao & Tang, 2025). This reflects an important academic shift from early output orientation to staged developmental preparation.

3.1.3 Multi-stakeholder Collaboration has Become More Prominent

Studies on the integration of sports and education increasingly regard physical development as a shared basis for both competitive performance and health promotion (Wang & Zhu, 2025). Domestic research also highlights the importance of coordination among schools, sport schools, clubs, coaches, parents, and support professionals. Tennis research argues that parents should participate in key stages of youth development and work closely with coaches and specialists (Bi, 2019), while LTAD 2.1 stresses communication among all coaches involved in training and competition planning (Sport for Life, 2017). These findings suggest that youth physical development is increasingly understood as a long-term system requiring coordinated support across multiple settings.

3.1.4 Maturity Status Stratification and Monitoring are Emerging Directions

Chinese research has also begun to incorporate biological maturation indicators such as peak height velocity (PHV) into the interpretation of training and evaluation. Maturity indicators are mainly used to explain differences among athletes of the same chronological age and to connect stage-specific tasks with training load and developmental rhythm (Bian, 2020). This trend is academically significant because it shifts evaluation beyond chronological age alone and introduces a more development-sensitive perspective into youth training research.

3.1.5 Evidence is Still Dominated by Reviews and Theoretical Analysis

Chinese studies are still dominated by literature review, theoretical analysis, and framework construction. However, sport-specific studies have begun to incorporate questionnaires, interviews, and field-based follow-up. Overall, domestic research has achieved growing conceptual coherence, but empirical validation remains relatively weak. This gap between theoretical synthesis and evidence support remains a central issue in the further development of LTAD-oriented research.

3.2 Problems in Youth Physical Development in China from an LTAD Perspective

Despite this conceptual progress, the literature reveals several persistent implementation problems. The central tension is no longer the absence of developmental ideas, but the limited translation of those ideas into stable practice.

3.2.1 Goal Evaluation Remains Overly Short-term

When training goals are reduced to rankings or a few test indicators, long-term variables such as movement quality, physical literacy, and recovery management are easily neglected. This weakens the developmental logic emphasized by LTAD and encourages short-cycle training behaviour.

3.2.2 Early Sport Specialization and Adult-oriented Training Practices Remain Prominent

Existing studies show that youth training is still influenced by premature specialization and the direct transfer of adult-oriented methods to developing athletes (Bi, 2019). This tendency compresses developmental stages and weakens the long-term orientation of youth physical development.

3.2.3 Foundational Training is Implemented Inconsistently, and Content Remains Fragmented

Although the principle of “foundation first, specialization later” is widely accepted, several studies indicate insufficient investment in general athletic development. Tennis research notes that traditional pathways focus too heavily on sport-specific technical work (Wang & Zhu, 2025). School-based studies also suggest that physical development curricula lack clear standards and coherent content systems. As a result, the provision of fundamental movement skills and general physical qualities remains fragmented across settings.

3.2.4 Monitoring Often Fails to form a Monitoring-to-prescription Loop

Research in the context of the integration of sports and education points to inadequate data collection and monitoring in grassroots practice, with athlete fatigue continuing to accumulate across training cycles in the absence of effective data support (Bi, 2019). In many cases, monitoring remains limited to testing and recording rather than informing training content, load adjustment, and competition decisions. This weakens the practical value of monitoring in stage-based and individualized training.

3.3 Analytical Summary

Taken together, the literature suggests that Chinese research has made clearer progress in conceptual framework construction than in practical delivery. LTAD-oriented ideas such as stage-appropriate goals, foundational training, multi-stakeholder coordination, and development-sensitive evaluation are increasingly well defined, yet their implementation remains constrained by short-term evaluation, premature specialization, fragmented provision, and weak monitoring-to-prescription links. Therefore, the main academic contribution of this study is to show that the key challenge in youth physical development in China lies not in the absence of developmental concepts, but in the difficulty of converting them into coherent, evidence-informed practice.

4 Conclusions and Future Directions

Taken together, the reviewed literature indicates that youth physical development in China is gradually shifting toward an LTAD-oriented framework that values developmentally appropriate stage goals, the early cultivation of fundamental movement skills and general physical qualities, and the progressive integration of sport-specific training. At the same time, the integration of sports and education and the growing use of practical athlete monitoring have created more favorable conditions for long-term development. Even so, a clear gap remains between conceptual progress and day-to-day implementation, especially in sport-specific programme design, the selection of meaningful monitoring indicators, and the consistent translation of monitoring results into training adjustment.

On this basis, future improvement should not depend on adding more complex testing or more intensive early specialization, but on strengthening coherence across the existing system. Evaluation should be aligned with stage-specific developmental tasks rather than short-term competitive ranking, early-stage programmes should continue to prioritize fundamental movement skills and general physical qualities, and simplified monitoring systems should be closely linked to training prescription so that data can inform real coaching decisions. At the system level, stronger coordination among schools, sport schools, and clubs is still needed to improve continuity in youth athlete development and to support a more sustainable long-term pathway.

References

- [1] Sport for Life. LTAD 2.1 [Z/OL]. [2026-01-03]. https://sportforlife.ca/wp-content/uploads/2017/04/LTAD-2.1-EN_web.pdf.
- [2] Tao T, Du G, Xing Z, et al. Optimizing the British youth athletic development model from the perspective of dynamic integration: A comparison of LTAD and YPD models [J]. *Journal of Qufu Normal University (Natural Science Edition)*, 2019, 45(4): 96-102.
- [3] Ma S. Exploring scientific principles of health-related physical training for primary and secondary school students based on the YPD model [C/OL]. In: *Proceedings of the Third Belt and Road High-Level Forum on Physical Training and the Third National Annual Conference on Physical Training*. Guilin, Guangxi, China, [2025]: 156.
- [4] Zong P, Yan J, Pang J. Construction of a physical development framework for Chinese children and adolescents from the perspective of LTAD theory [C/OL]. In: *Proceedings of the Seventh China Conference on Physical Training Science*. Online conference, [2025]: 1116-1129.
- [5] Bian Z. Optimization of physical training content for Chinese youth triathletes from the perspective of LTAD theory [D/OL]. Wuhan: Wuhan Sports University, 2020.
- [6] Bi X. A study on the core elements of the long-term athlete development model for tennis players [D/OL]. Nanjing: Nanjing Sport Institute, 2019.
- [7] Zhang T, Wen Y, Shen Y. A theoretical model of long-term development for young swimmers during childhood and adolescence [J/OL]. *China Sport Science and Technology*, 2018, 54(4): 45-52, 91.
- [8] Gao F, Tang M. Pathways for cross-sport talent identification and transfer among youth athletes based on LTAD theory [C/OL]. In: *Proceedings of the 13th National Sports Science Congress - Poster Exchange (Sport Training Division III)*. Tianjin, China, [2025]: 223-225.
- [9] Wang W, Zhu R. Research on physical development for youth athletes in the context of the integration of sports and education: Based on the LTAD theoretical model [C/OL]. In: *Proceedings of the Eighth China Summit Forum on Physical Training and the Second China Annual Conference on Physical Training*. Wuhan, Hubei, China, [2025]: 1330-1335.