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ORIGINAL

THE INTEGRATION PROGRAM OF PHYSICAL AND TECHNICAL TRAINING FOR TRACK AND FIELD ATHLETES BASED ON MODERN TRAINING CONCEPTS

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ABSTRACT

Integrating physical fitness and technical training helps to improve the explosive force and endurance of track and field athletes and ensure their performance. In this paper, under the modern training concept, different kinds of physical training methods are designed to monitor the physical information of athletes, obtain the physical data of track and field athletes, so as to develop a reasonable training program and compare with the traditional training methods. In the flexibility test, the difference of seated forward body flexion was large, the experimental group increased from 15.5833 to 28.850, while the control increased from the initial 13.35 to 13.883.In the strength training, the one-minute sit-up changed from the initial 50.3333 to 83.17, while the control group only increased from the initial 49.8333 to 53, which indicates that the modern training concept is more effective than the In the endurance and sensitivity test, the meter run of the experimental group before and after training improved more significantly, changing from the initial 17.085 to 7.74, indicating that the modern training concept improves the endurance of the athletes and makes the athletes more explosive. It proves that the integration program based on the modern training concept improves the athletes' special performance and makes the athletes more explosive.

KEYWORDS: Physical and Technical Training; Track and Field Athletes; Modern Training Concepts; Fitness Information; Fusion Program

1. INTRODUCTION

As an important part of the sports program, track and field has extremely high requirements for athletes' physical fitness and technology. In modern sports competition, how to improve the athletic level of track and field athletes and realize the perfect integration of physical fitness and technology is the focus of attention of many coaches and athletes (Bulğay et al., 2022; Mingtaou, 2023). With the continuous development of science and technology and the updating of training concepts, traditional training methods have been difficult to meet the needs of modern track and field sports, and modern training methods have brought new opportunities and challenges to the training of track and field athletes. In other words, as an athlete, only with a high level of physical ability can he or she withstand heavy load training and high intensity competition, in order to ensure the correct formation of technical movements and the rapid improvement of sports performance (Pacewicz & Smith, 2023; Wang, 2022). Especially in the game to maintain a good psychological state, and help to prevent injuries and prolong the sports life. Therefore, how to scientifically and reasonably arrange the training content, quickly and effectively improve the physical fitness level of athletes has been a hot topic of concern for the majority of coaches and the key content of the training work (Wang, 2023). This paper combines the modern training concept of multi-joint, multi-plane training, pay more attention to the balance control and proprioception of the training advantages, the development of strength qualities, static stretching, sensitivity, endurance and speed of five aspects of the training program. Use sports monitoring equipment to record the athletes' speed, step frequency, stride length, heart rate and other sports data, to obtain the athletes' physical information. Use Excel and other statistical software to carry out descriptive statistical analysis of the data, to derive the effect of different training effects on the performance of the athletes. Twenty track and field athletes were selected as research subjects and randomly assigned to the experimental and control groups, with the experimental group using the fusion training program and the control group using traditional training methods. The training cycle was 18 weeks, and the results of physical training of track and field athletes were analyzed from the results of the flexibility line test, the technical performance of both groups was evaluated by the sensitivity and endurance test, and the strength quality before and after the training was tested in order to evaluate the psychological and physiological status of the athletes. The physical and technical training integration program was designed to further improve the adaptability of the athletes' organism to training and competition.

2. Related Works

When training the physical fitness and technique of track and field athletes, Loturco, I. et al. analyzed and researched ten speed training methods to improve athletes' sprinting ability, and discussed the training methods of

maximal speed sprinting, form running, resistance sprinting, overdrive running, uphill and downhill running. With the consideration of athletes' physical fitness, the training methods of sprinting are combined with physical fitness to improve athletes' performance and make the training methods more scientific (Loturco et al., 2023). Jiang, S. et al. conducted a study on the training methods with different training loads and 50 male students as the experimental subjects, of which 30 were from the school's track and field training team, and 20 were ordinary students. The results of different training methods can be derived from the sports performance, according to the results of the development of physical training and technical training combined training methods, to improve the performance of athletes (Jiang et al., 2022). Ding, W. et al. explored and researched on the core strength training methods, and analyzed the impact of core strength training on track and field running, so as to develop the integration of physical fitness and technical training programs (Ding et al., 2022). According to the athletes' fitness test, this program can help the athletes' performance. Zhao, K. et al. analyzed the fitness and technique of track and field throwing athletes, and analyzed the performance difference between different athletes, and according to the difference between the athletes' fitness and technique, they formulated the training method that meets the athletes' physique (Zhao et al., 2023). To make the training mode of track and field throwing athletes more scientific and suitable for daily training, which can improve the performance of athletes. Zhuravleva, T. et al. investigated and analyzed the focus of attention of track and field athletes when they performed the unarmed shot put, and came up with the performance of different athletes who threw the shot put with different focuses (Zhuravleva & Aiken, 2023). According to the results to develop the athlete's training program, the athlete's physical and technical way to develop a combination of the athlete's physical and technical way, so that the athlete in the throwing process to slow down the nervousness, improve their own focus, improve the athlete's physical and technical, so that the athlete to get excellent results. Wang, L. et al. on the youth of amateur track and field training of the physical training of the basic strategy and the special strategy of the focus and analysis, to guide the formulation of the most reasonable physical training plan, selection of the most suitable physical training methods, and the use of genetic algorithms to combine physical training and technical training with each other, so as to realize the stable improvement of athletes' physical fitness and achieve the ideal physical training goals (Wang & Chen, 2023). At the same time, the introduction of scientific quantitative indicators and personalized indicators into sports training can timely analyze the performance of athletes, adjust the training plan, so that the athletes' technology and physical fitness progress. Zhao, Z. et al. analyzed the physical quality of athletes, and used the discrete dynamic approach to establish a model to analyze and control the training progress and mode of athletes of track and field sprinters, and designed a model that combines the physical fitness and training of athletes with the physical fitness of athletes (Zhao, 2022). Designed the method of

integrating athletes' physical fitness and training technology, which provides a reference for coaches engaged in sprint training, so that athletes can choose suitable training methods for themselves, making the training program more scientific and improving athletes' performance.

3. Subject and Methodology of the Study

3.1 Research Methodology

3.1.1 Training Methods

Functional training is a multi-joint, holistic, multi-dimensional approach to improving specialized athletic ability by strengthening the core and making the nervous system more effective, including acceleration, stabilization and deceleration exercises for movement articulation. Modern training philosophy is considered to be an activity that trains control and precision of movement or posture rather than muscle development. The modern training philosophy does not emphasize the overdevelopment of limb strength in a specific movement, but rather multi-joint, multi-planar training and incorporates balance control and proprioception as important elements of the modern training philosophy and emphasizes the integration of whole-body movement and balance under control (de Oliveira et al., 2024; Shen et al., 2020). Balance and stability is the merit of competitive sports, the core of the modern training concept is to train the integration of technical movements and the proprioception of the neuromuscular system, and proprioception is an important way of technical sensory training. Modern training concept is not an independent, detached from the special actual combat of the large load physical training, compared with the general physical training, so that the training is more subordinate to the needs of the game, more helpful to improve the athletes' special competitive ability. In addition, the modern training concept is also manifested in the assessment of the effectiveness of static postures and power chains, the structural design of the efficiency of resistance training, which can be used to correct compensations, dysfunctions and core stability. The qualitative characteristics of modern training concepts can be reflected by range of motion, body control, balance and general stability (Edouard et al., 2022; Hut et al., 2023).

The advantage of modern training concepts is the design of specialized physical activities for the improvement of athletes' sport-specific abilities, after ensuring that they have a solid base of physical fitness. The intensity, duration and frequency of aerobic and anaerobic exercises of the modern training concept should be based on the different requirements of the specialization, and the form of resistance training, loads and duration of exercises depend on the needs of the specialization for the athlete. Based on the modern training concept of track and field athletes physical and technical training is mainly divided into five, including strength training, stretching training, sensitivity

training, endurance training, speed training.

Table 1 shows the physical and technical training programs under the modern training concept, these types of training with each other, can comprehensively improve the athletes' competitive ability, from enhancing muscle strength to improve flexibility, reaction speed, as well as cardiorespiratory function and muscular endurance, etc., to lay the foundation for the athletes to excel on the field of play. Clear training methods and objectives and reasonable training schedule can ensure the efficiency and relevance of training, and help athletes to break through and realize the improvement of competitive level.

Table 1:(A) Physical and technical training programs under modern training concepts

TYPE OF TRAINING	TRAINING CONTENT	TRAINING METHODS	TRAINING OBJECTIVES	TRAINING TIME
STRENGTH TRAINING	Enhance muscular strength, explosive power and endurance	Weight training (barbells, dumbbells, machines), core training (abs, back, arm muscles), explosive training (squat jumps, vertical jumps, explosive leg training)	Improve athletic performance in starting, long jump and throwing events	According to the athlete's physical condition and training program, arrange 2-3 times every 5 days, each training 60-90 minutes
STATIC STRETCHING	Improve flexibility	Active stretching, passive stretching	Increase the range of motion of joints, prevent sports injuries, and improve flexibility and performance.	Before and after training, 10-15 minutes before and after each training session.
SENSITIVITY TRAINING	Improve reaction speed, agility	Reaction training (starting gun sound,	Improve flexibility and coordination, adapt quickly to changes in competition and optimize technical performance.	1 time every 5 days, 30-45 minutes per training session.

Table 1: (B) Physical and technical training programs under modern training concepts

TYPE OF TRAINING	TRAINING CONTENT	TRAINING METHODS	TRAINING OBJECTIVES	TRAINING TIME
ENDURANCE TRAINING	Coordination	Light stimulation, sound stimulation),	Enhance athletes' endurance performance in different situations.	According to the athlete's physical condition and training program, 2-3 times per 5 days, 60-120 minutes per training session.
SPEED TRAINING	Improve cardiorespiratory fitness and muscular endurance, delaying the onset of fatigue	Agility training (change of direction running,	Improve starting reaction speed and acceleration, optimize technical movements, improve efficiency and speed, and maintain speed stability.	2-3 times per 5 days, 45-60 minutes per session

3.1.2 Data Collection Methods

Utilizing motion monitoring devices such as GPS trackers, heart rate monitors, motion capture systems, etc., real-time recording of athletes' movement data including speed, step frequency, stride length, and heart rate.

3.1.3 Data Analysis Methods

Statistical software such as Excel was used to statistically analyze the collected data, including descriptive statistics, ANOVA, and correlation analysis, in order to reveal the effects of different training methods on athletes' fitness and technique.

3.1.4 Assessment and Feedback Methods

Virtual reality technology VR is used to simulate different training scenarios and competition situations, allowing athletes to train in a virtual environment, improving their ability to cope with a variety of situations, and

recording and analyzing the training effect through software (Hong et al., 2023; Zhou, 2021).

3.2 Facilities and Equipment

(1) Motion monitoring devices are mainly used to monitor athletes' motion data, such as speed, step frequency and stride length. Through the built-in sensors and GPS modules, these devices can record the athletes' movement trajectory and various data in real time, and transmit the data to the cloud for analysis. Coaches can view the athlete's training situation through cell phones or computers and adjust the training program in time.

(2) Heart rate monitoring equipment is mainly used to monitor the athlete's heart rate, through the heart rate monitor worn on the body, it can monitor the athlete's heart rate changes in real time, help the coaches to understand the athlete's psychological and physiological state, adjust the training intensity and rhythm, and enhance the training effect.

3.3 Evaluation Indicators

3.3.1 Physical Fitness Improvement Indicators

Strength qualities are assessed by measuring the maximum number of repetitions under specific weight training, such as deep squat, bench press, and explosive strength tests such as vertical jump height, to assess the improvement of athletes' muscular strength, explosive strength and endurance. Flexibility was assessed using tests such as joint range of motion test ROM and seated forward bend to evaluate the effect of static stretching training on the improvement of athletes' flexibility.

Endurance tests use long-distance running tests, such as 3000-meter and 5000-meter runs, heart rate recovery after interval training and other indicators to assess the improvement of cardiorespiratory function and muscular endurance in athletes (Nickels et al., 2021; Varillas Delgado et al., 2020).

3.3.2 Technical Performance Indicators

Starting Reaction Speed Use the starting gunshot test or light stimulation reaction test to assess whether the athletes' starting reaction speed has improved. Technical Movement Optimization. The details of athletes' movements are recorded by high-speed cameras, and combined with the assessment of technical coaches, to examine whether athletes' technical movements in high jump and sprint events are more standardized and efficient. Speed Stability. In sprint tests such as 200 meters and 400 meters, the stability

and speed sustaining ability of the athletes are assessed.

3.3.3 Indicators of Mental and Physical State

Heart rate dynamic assessment utilizes heart rate monitoring technology to continuously track and record athletes' heart rate fluctuations under diverse training intensities, a process that not only reveals the athletes' physical loading responses, but also indirectly maps the adaptability of their psychological tolerance and body regulatory mechanisms. The monitoring of athletic performance was combined with a GPS tracker to capture key athletic parameters such as real-time speed, stride frequency fluctuations, and stride length adjustments of the athletes during training (Kwon et al., 2020; Rogers et al., 2022).

3.4 Subjects of Study

In this paper, 20 of the professional track and field athletes from the Heilongjiang Physical Fitness Team, Harbin Physical Fitness Team, Heilongjiang Physical Fitness School and Harbin Physical Fitness School were the subjects of the study, and all of the 20 male track and field athletes in the statistics were level 3 athletes.

Among them, 10 focused on the long jump event and the other 10 focused on the 100-meter dash. Notably, there were no athletes in the high jump event in this test. Regarding injuries, none of the 20 athletes had any injury records.

4. Analysis of the Results of the Integration of Physical and Technical Training Programs

4.1 Flexibility Test

In order to be able to accurately derive the training effect of the fusion program of physical and technical training, it is necessary to test it. The experimental group and the control group were established separately, the experimental group used the fusion program designed in this paper, and the control group was the traditional training method, and the two groups were trained differently, so as to obtain the training effect of different programs. Twenty male track and field athletes were selected as experimental subjects, among which one was decathlon, 14 were track events and five were field events. The duration of the experiment was about 18 weeks, divided into three phases, and Table 2 shows the flexibility test of the control and experimental groups before training. Where **** represents a highly significant difference and ** represents a significant difference.

Table 2: Flexibility test in control and experimental groups before training

TEST METRICS	GROUPS	AVERAGE VALUE	STANDARD DEVIATION	T	P	SIGNIFICANCE LEVEL
HORIZONTAL FORK	Experimental group	25.1667	6.121	0.283	0.783	-
	Control group	26.1667	6.137	-	-	-
SIT-UP-AND-BEND	Experimental group	15.5833	3.32109	1.019	0.332	-
	Control group	13.35	4.21652	-	-	-
BACK HOOKS OF THE HANDS	Experimental group	9	3.2249	0.241	0.815	-
	Control group	8.5	3.937	-	-	-

The flexibility test of the control and experimental groups after training is shown in Table 3, and there is a very significant difference in the cross-fork of the experimental group before and after training, which changed from 25.1667 to 8.283. Compared with the result of the control group, which changed from 26.1667 to 24.700, the cross-fork training of the experimental group had a significant change, and the athletes of track and field have a greater progress, which proves that the modern training concept is better than the traditional training concept of the effect is better. And there is also a very big difference in seated forward body flexion before and after training, the experimental group increased from 15.5833 to 28.850, indicating that the means and methods of positive kicking, lateral kicking, and stretching after aerobic endurance training in the training program have a significant effect on the improvement of the flexibility of the lower limbs, the waist, and the hip joints, which improves the flexibility of the athletes, and promotes the athletes' self-development.

Table 3: Flexibility test of control and experimental groups after training

TEST METRICS	GROUPS	AVERAGE VALUE	STANDARD DEVIATION	T	P	SIGNIFICANCE LEVEL
HORIZONTAL FORK	Experimental group	8.283	2.697	6.097	0.000	****
	Control group	24.700	6.0183	-	-	-
SIT-UP-AND-BEND	Experimental group	28.850	2.8012	6.181	0.000	****
	Control group	13.883	4.3083	-	-	-
BACK HOOKS OF THE HANDS	Experimental group	6.67	3.266	0.419	0.684	-
	Control group	7.50	3.619	-	-	-

4.2 Sensitivity and Endurance Tests

Sensitivity and endurance test is mainly to test the athletes' resilience and durability in sports, which has a greater impact on track and field athletes, and usually many track and field athletes need to have strong endurance and explosive force to get excellent performance. Using the meter run, 60-meter run and 3000-meter run as the test indexes, the results of the sensitivity and endurance tests of the two groups before training are shown in Table 4, and the difference between the mean and standard deviation of the two groups before training is not large, and neither of them is significant.

Table 4: Results of sensitivity and endurance tests in the two groups before training

TEST METRICS	GROUPS	AVERAGE VALUE	STANDARD DEVIATION	T	P	SIGNIFICANCE LEVEL
YONAGO RUN	Experimental Group	17.085	1.17714	1.08	0.305	-
	Control Group	15.97	2.23711	-	-	-
60 METER RUN	Experimental Group	7.4117	0.25895	0.627	0.545	-
	Control Group	7.51	0.28397	-	-	-
3000 METER RUN	Experimental Group	13.745	1.65592	0.439	0.280	-
	Control Group	13.37	1.28061	-	-	-

The results of the sensitivity and endurance tests of the two groups after training are shown in Table 5, which shows that the 3000 meters of the experimental group before and after training had a significant improvement, changing from 13.745 to 11.25, with a faster speed. While the control group, due to the traditional training method, the speed of 3000 meters was not significantly improved, changing from 13.37 to 12.425. Based on the fusion program designed by the modern training concept, the meter run and 60-meter run were more significantly improved, respectively, from 17.085 to 7.74 and 7.4117 to 7.0250, with a more significant improvement in the mean value. It shows that the weekly training of speed quality in the physical training program has a great enhancement of speed quality, and the enhancement of coordination training means and methods and trunk strength has a great enhancement of sensitivity and coordination quality, which has a very obvious effect and can enhance the physical quality of athletes, and proves that the modern training program can be widely promoted in the physical fitness of track and field athletes in the technical training.

Table 5: Results of sensitivity and endurance tests in both groups after training

TEST METRICS	GROUPS	AVERAGE VALUE	STANDARD DEVIATION	T	P	SIGNIFICANCE LEVEL
YONAGO RUN	Experimental Group	7.74	0.9882	6.909	0.000	****
	Control Group	14.1317	2.0802	-	-	-
60 METER RUN	Experimental Group	7.0250	0.1568	5.008	0.001	****
	Control Group	7.5633	0.2115	-	-	-
3000 METER RUN	Experimental Group	11.25	0.8064	2.509	0.031	**
	Control Group	12.425	0.8160	-	-	-

4.3 Strength Tests

Strength quality test is to assess the muscular strength of athletes, and strength quality is very important for athletes' body, which affects athletes' sports performance and daily activities, etc. If the strength quality is not enough there may be injuries. Weighted pull-ups, 20 seconds pull-ups, flexed arm hangs, one-minute sit-ups, and three-stage frog jumps and half-squat heel raises are used as the test indicators. Table 6 shows the strength quality of the experimental group and the control group before the training. In the 20-second pull-ups test, the two groups have the same mean value, which is 14.3333, and there is no significant difference in the indexes.

Table 6: Strength qualities of the experimental and control groups before training

TEST METRICS	GROUPS	AVERAGE VALUE	STANDARD DEVIATION	T	P	SIGNIFICANCE LEVEL
WEIGHTED PULL-UPS	Experimental Group	33.75	5.18411	0.973	0.353	-
	Control Group	37.0833	6.59861	-	-	-
20 SECONDS PULL-UPS	Experimental Group	14.3333	1.0328	0	1.00	-
	Control Group	14.3333	1.50555	-	-	-
FLEXED ARM HANGS	Experimental Group	26.1083	4.23945	0.922	0.378	-
	Control Group	28.9833	6.35754	-	-	-
ONE-MINUTE SIT-UPS	Experimental Group	50.3333	5.50151	0.133	0.897	-
	Control Group	49.8333	7.41395	-	-	-
TRIPLE FROG JUMP	Experimental Group	8.4367	0.34938	1.22	0.905	-
	Control Group	8.4617	0.35471	-	-	-
HALF SQUAT HEEL RAISE	Experimental Group	122.3333	3.86868	0.397	0.704	
	Control Group	123.3333	4.91596	-	-	-

Table 7 shows the strength quality of the experimental group and the control group after training, it can be clearly seen that there is a significant difference between the strength quality of the experimental group and the

control group after training, in which the weighted pull-ups, 20s pull-ups, flexed arm hangs, and one-minute sit-ups have a very obvious difference. In particular, the one-minute sit-up changed from the initial 50.3333 to 83.17, while the traditional training method showed less improvement, only from the initial 49.8333 to 53, which was much less effective than the experimental group that adopted the fusion training program. The difference of half squat heel lift is also more obvious, the experimental group improved from 122.3333 to 134.167, which makes the strength quality of track and field athletes have obvious improvement. These data results show that the upper and lower extremity training means of modern training such as bench press, fast jerk, half squat, jumping sponge mat, and the trunk strength exercise means throughout the training of the experimental group have a significant effect on improving the upper and lower extremity strength endurance, explosive strength, and even trunk strength amplitude in a short period of time, which can improve the athletes' physical fitness. It further proves that the designed program is conducive to the athletes to maintain a good psychological and physiological state, and good overall quality.

Table 7: Strength qualities of the experimental and control groups after training

TEST METRICS	GROUPS	AVERAGE VALUE	STANDARD DEVIATION	T	P	SIGNIFICANCE LEVEL
WEIGHTED PULL-UPS	Experimental Group	49.583	3.6799	3.373	0.007	****
	Control Group	40.083	5.8345	-	-	-
20 SECONDS PULL-UPS	Experimental Group	30.17	2.483	12.143	0.00	****
	Control Group	16.00	1.414	-	-	-
FLEXED ARM HANGS	Experimental Group	51.83	2.5216	7.070	0.00	****
	Control Group	31.498	6.5715	-	-	-
ONE-MINUTE SIT-UPS	Experimental Group	83.17	3.189	9.623	0.00	****
	Control Group	53	6.986	-	-	-
TRIPLE FROG JUMP	Experimental Group	9.9917	0.5765	6.087	0.00	****
	Control Group	8.445	0.2343	-	-	-
HALF SQUAT HEEL RAISE	Experimental Group	134.167	0.803	2.96	0.014	**
	Control Group	126.00	0.816	-	-	-

5. Conclusion

In this paper, on the basis of modern training concepts, for the functional training of track and field athletes, the design uses a variety of specialized

physical training such as strength, stretching, agility, endurance and speed training, and combines the technology to formulate a training program that meets the physical condition of the athletes. The results of the training test are as follows: (1) In the flexibility test, there is a very big difference between the two groups of seated forward body flexion, the fusion program group increased from 15.5833 to 28.850, while the traditional training method increased from the initial 13.35 to 13.883, and there is an obvious gap between the results of the two groups, and the modern training concepts help to improve the special ability of track and field athletes. (2) In endurance training, before and after training, the experimental group's meter run and 60-meter run were more significantly improved, respectively, from 17.085 to 7.74, and from 7.4117 to 7.0250, and the fusion program was significantly improved, which indicates that the experimental group's fusion of physical fitness and technical training methods can improve the athletes' performance, and that the modern training concepts are more suitable for track and field athletes than the traditional training methods, to Improve the physical quality. (3) In the strength training, the one-minute sit-up changed from the initial 50.3333 to 83.17, while the control group's enhancement is less, just from the beginning of 49.8333 to 53. Physical and technical virtual company fusion program can effectively improve the athletes' physical and muscular aspects of the ability to achieve the best performance for the athletes to provide strong support.

6. Discussion

In the future, the study can be extended to more track and field events and athletes of different levels to verify the generalizability and effectiveness of this training fusion protocol. Meanwhile, the fusion training program can also be improved in the following aspects: (1) Sensitive coordination exercises have higher requirements for athletes' excitability and nervous system, and generally should not be placed after training sessions with large amounts of exercise, and the number and duration of exercises should not be too many and too long, and ensure that there is enough time for inter-singing, or it will affect the training effect. (2) Should also be combined with diversified training methods, practice methods and means to be flexible and diverse attention to its regulatory, recreational and fun, in order to facilitate the athletes to maintain a high degree of excitability under the premise of improving the functional level of various analyzers. (3) Attention should be paid to the age characteristics of athletes, sensitivity and coordination is a comprehensive manifestation of the human body's various abilities, by the balance, rhythm, reaction and spatial positioning ability and other factors. And the degree of improvement of these abilities at all ages is not synchronized, should pay attention to the development of balance, reaction ability of the best time, the development of flexibility is selected at the best age. Therefore, it is important to note that the training content should be emphasized at different ages.

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