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PSYCHO-PHYSIOLOGICAL CHARACTERISTICS OF MIDDLE-DISTANCE RUNNERS AGED 15-16

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Abstract:
The scope of the article is determining the psycho-physiological characteristics of middle-distance runners aged 15-16 which play an important role in providing scientific information for the use of exercise volume and intensity. So as to align with the goals and content of the training in order to improve the athlete's athletic performance, and at the same time, overcome difficulties to achieve the goal in specialized endurance education. Identifying psychological and physiological characteristics of middle-distance athletes at the ages of 15-16 plays an important role in providing scientific information for the use of the amount of movement, intensity, and break to suit the objectives and contents of training to improve the athletic performance of athletes. At the same time, difficulties are overcome to achieve the purpose of educating professional endurance.

Keywords: characteristics, psychology, physiology, athletes, ages 15-16

1. Introduction

The age of 15-16 is the age when children begin to study in high school and is also the period when they are very sensitive and develop strong personality characteristics. However, they are on the way to gradually improving their mental and physiological functions in the body, so they do not have sustainable properties. Therefore, in endurance education, regular attention should be paid to conducting moral, psychological, and willpower education for children. The process of body development according to this age has two basic physiological characteristics. First, the development is irregular, alternating with periods of rapid development are periods of relatively slow and stable development. The second feature is asynchronous development, organs and organ systems do not develop at the same time, some organs develop fast, and some organs develop slowly. [3]

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Therefore, sports training for 15 - 16 year olds is a training process that takes place on a body that is still maturing and developing. That makes the training of young athletes somewhat complicated and requires the trainer to master the psycho-physiological characteristics of the age to use the amount of exercise to suit the goals and content. train. The process of researching the topic is mainly using the method of analyzing and synthesizing documents.

2. Research results

2.1. Psychological characteristics of male middle-distance runners aged 15-16

2.1.1. The role of psychology in sports activities

In daily life as well as in the process of sports training, the movement always alternates between a dynamic state and a resting state or between excitement and inhibition. This is also characteristic of the functioning of living organisms. Psychological training in sports aims to control balance and mental stability, improve muscle strength and athlete's mind based on the characteristics of the individual's living body and general movement laws.

In practice, the achievement is extremely important, it marks the maturity of sports talent. But the way each athlete goes to the top of glory is also a result that leaves a deep mark on each game and the athlete's life. Therefore, when facing different situations, it is necessary to know how to resolve to put yourself in the best and most beneficial psychological state.

In order to have a psychologically ready state of mind, it is necessary to undergo a sustained training process to form the active and positive psychological abilities and qualities of the athlete. Mental readiness and psychological endurance are influenced by many factors, including experience, expertise, and the ability to control and regulate the emotions of each individual. The study of the psychological evaluation of athletes will provide an important source of scientific data in the selection and training of sports.

2.1.2. Psychological characteristics of athletes aged 15-16

The ages of 15-16 are the second stage of puberty. During this period great personal development can be observed. Because biological processes are so powerful, with the important changes the organism undergoes during this period of development, the focus of attention also changes and they raise new questions, relationships, and relationships. and personal feelings and also biological changes have led to a huge emotional imbalance and mental instability during this age period. On the other hand, they are also very eager to build their own ways of thinking and want to receive comments about themselves. From the above characteristics, in order to educate and train a comprehensive athlete at this age, first of all, there needs to be encouragement from the coach, then there needs to be cooperation from the family, schools and society, the work of education, training and training will be highly effective. [2]

The age of 15-16 is a period when children are very sensitive and have strong and flexible development of personality characteristics such as: calm, enthusiastic, hot-

tempered, and anxious. But they are on the way. Therefore, in endurance education, it is necessary to regularly pay attention to educating children about morality, will, and perseverance. Help them overcome internal and external obstacles and difficulties by exercising their will to endure the stress of practice.

2.1.3. Effect of psychological function on athletic performance

Psychological function plays a dominant role in all human life activities and can create abilities, and active qualities - ability bias. A psychological function is the fundamental basis of all human behavior and attitude towards reality in all life activities in general and sports activities in particular.

The reality of sports training and competition increasingly proves the important role of psychological factors, especially in important competitions, at a tough time, deciding which athlete has a stable mentality. Gold is more advantageous and easier to win. Therefore, right now, right from the initial selection of young athletes, people have also focused on the individual psychological factor of the athlete. At the same time, we also see that in the teams of many countries participating in major sports tournaments, there are always experts or psychologists accompanying them to advise and train the psychology of athletes. So, through here we see that the psychological factor plays a very important role in sports training and competition.

2.2. Physiological characteristics of male athletes aged 15-16 and physiological basis of endurance qualities

Mid-distance running (800m, 1500m) is a sport in the sub-maximal motor capacity region, fatigue is mainly related to the oxygen transport system and the accumulation of products in the metabolism from the main source of energy is glycogen, especially lactic acid in the blood, which is very high (young athletes are usually 15mmol/liter after finishing the distance, peak athletes have higher blood lactic acid levels than athletes. young athletes), the pH in muscle cells, in the blood decreases sharply, and the oxygen debt is high, thereby showing that middle-distance running is characterized by typical activity involving the following 3 energy systems: Aerobic glycogen (aerobic sugar); anaerobic glycogen (anaerobic sugar with lactic acid production); ATP/CP (non-lactic anaerobic). The ratio of the above 3 systems provided by Dr. Gutter Lange (German) - Senior Lecturer of the International Athletics Federation is:

- For a distance of 800m, the aerobic route accounts for 60%, lactic acid anaerobes 30%, non-lactic anaerobes 10%.
- For a distance of 1500m, aerobic sugar accounts for 72%, lactic-producing anaerobes 20%, non-lactic anaerobes 8%.

Thus, it is shown here that middle-distance training should prioritize the development of aerobic endurance for athletes.

2.2.1. Physiological characteristics of athletes aged 15-16

Based on the morphological, functional, and developmental characteristics of the body, the age group 15-16 is the age at the end of middle school and the beginning of high school.

- Nervous system: at this age, the physical development has gradually completed, and the size of the brain and medulla oblongata has reached almost adult level. The analytical-synthetic activity of the cerebral cortex increased, and thinking was well formed. [3], [7].
- Metabolism and energy: the main feature of adolescence is that anabolism prevails over catabolism, due to the need for growth and body formation. Energy exchange in quiet conditions at the age of 15: 4.2Kal/m2/hour, to the age of 20: 3.8Kal/m2/hour.
- Blood system: blood volume is proportional to body weight and higher in adults, the amount of red blood cells reaches adult levels.
- Circulatory system: the rate of contraction of the heart at the age of 16 is 70-78 beats/minute, and the blood flow volume per 1kg in volume per minute (relative minute volume) is 60-70ml. Minute volume for most adults is 24-28 l/min, systolic volume is 120-140 ml. systolic blood pressure is 110-120 mmHg, and diastolic blood pressure is 70-90 mmHg. [3]
- Respiratory system: physiological characteristics of age clearly affect respiratory function. Respiratory rate 12-18 times/minute. Respiratory depth (circulation air) is almost 400-500ml for adults. Relative vital capacity, i.e. vital capacity per 1kg body weight is also close to that of an adult 80ml/1kg in weight, with a maximum oxygen absorption capacity (VO_2max) of 3.5 liters/minute. [3]

2.2.2. Physiological basis of endurance qualities

a. The nature of endurance

The essence of endurance is the body's ability to reach max 2, athletes with good endurance often have very high VO_2 max (5-6 liters/min).

In exercise physiology, endurance typically characterizes the ability to perform physical activities lasting 2-3 minutes or more, with the participation of a large muscle mass (from 1/ 2 whole body muscles) by the absorption of oxygen to provide energy for working muscles, mainly or entirely by the aerobic route.

Endurance depends on the body's VO_2 max capacity and long-term ability to maintain a high oxygen intake. A person's VO_2 max level determines their ability to work in aerobic conditions. The higher the VO_2 max, the greater the maximum operating capacity.

The ability to VO_2 max is determined by the ability of two main functional systems: One is the oxygen transport system responsible for absorbing oxygen from the external environment and transporting oxygen to the body's organs and the second is the musculoskeletal system uses the supplied oxygen. [3]

b. Oxygen transport system

The oxygen transport system includes the external respiratory system, blood, and cardiovascular system. The function of each part of this system ultimately determines the body's ability to carry oxygen.

The respiratory system is the first stage of the oxygen transport system. The respiratory system ensures the exchange of gases between the outside air and the blood and the heart-heart, so that the oxygen pressure in the arterial blood is maintained at the level necessary to supply the muscles and organs. To develop endurance, the respiratory system must undergo changes in both structure and function.

c. Blood system

The volume and content of hemoglobin determine the body's ability to carry oxygen because oxygen is transported from the lungs to the tissues by combining with the hemoglobin of red blood cells.

In normal people and athletes in other sports, the amount of hemoglobin in the blood is about 700-900g, while in endurance athletes about 1000-1200g [3, p.407]. Thus, red blood cells and hemoglobin are actually increased in endurance athletes. However, because their circulating blood volume is larger, that amount of red blood cells and hemoglobin is just enough to ensure a normal level in the blood.

During endurance activities, i.e., aerobic activities, the concentration of lactic acid in the blood is inversely proportional to the duration of exercise. That suggests that lactic acid content also indicates human endurance performance [3]. During endurance training with aerobic exercise under maximal lactic acid content in the muscles and blood decreases. Therefore, the concentration of lactic acid in the blood of endurance athletes is lower than that of normal people and athletes of other sports.

In summary, endurance training not only increases the capacity to VO_2 max, but also reduces the lactic acid content in the blood and thus increases the body's capacity for sustained aerobic activity. It is one of the most important mechanisms for improving endurance in athletes.

d. Cardiovascular system

Because external respiration is often higher than the body's ability to absorb oxygen, in fact, the ability to transport oxygen mainly depends on the circulatory system, not the respiratory system, especially on the cardiovascular system. on the heart's ability to pump blood

In order to develop endurance, the heart and blood vessels undergo profound changes in both structure and function, manifest in quiet and in motion with varying amounts of exercise.

The structural and functional changes in quiet are important for increasing the maximum capacity of the heart to exercise. When performing maximum aerobic exercise, the maximum minute volume of endurance athletes can be double that of the average person, reaching 38-40 l/min. Such high maximal blood volume in endurance athletes is mainly due to increased systolic volume. Increased systolic volume is the most important

functional effect of endurance training on the cardiovascular system and on the oxygen transport system in general. The maximum systolic volume of endurance athletes is up to 190-210ml, while in normal people it is not more than 130ml [3].

e. Oxygen utilization system - muscle system

A striking feature of the muscle composition of high-achieving athletes in endurance sports is their very high proportion of slow (group I) fibers in the muscle. There is a close relationship between slow muscle fiber ratio and maximum aerobic capacity. Athletes with a high percentage of slow muscle fibers often have a high maximum aerobic capacity as well. In high-level marathon runners, the proportion of slow fibers accounts for 80% of the total muscle mass in the bundle, while in 100m runners, this ratio is only 20-30%. Strength training, including endurance training, did not change the ratio of slow and fast muscle fibers in the muscle bundle. However, endurance training can increase the percentage of fast-fibre group IIA and decrease the percentage of fast-tissue group IIB. Group IIA muscle fibers are muscle fibers that have a higher ability to exchange energy by oxidative pathways than group IIB. Thus, endurance training can increase the proportion of muscle fibers that have an aerobic metabolic capacity that is adapted to endurance activity.

By examining the characteristics of the oxygen transport system and the oxygen utilization system in endurance activities, we find that endurance training leads to two basic consequences: One is: improves maximal aerobic capacity multi of the body. The second is: to improve the performance of the body when operating at low capacity for a long time. [3].

2.3. Characterization of energy systems in some cyclical athletics

Energy levels for some middle-distance, middle-long, and marathon athletics are shown in Table 1.

Table 1: Contribution rates of energy systems in some disciplines of athletics

Content	ATP-CP	Anaerobic-Lac	Aerobic
800m	10 %	30 %	60 %
1500m	8%	20 %	72 %
3000m	5 %	15 %	80 %
5000m	4 %	10 %	86 %
10.000m	3-2 %	12-8 %	85-90 %
42195m	0 %	5-2 %	95-98 %

Note: According to Dr. Gunter Lange.

There are limits to the energy systems that provide muscle for maximum exertion. The incorrect use of exercises will not promote the full capacity of the energy systems, on the contrary, it will also create a reflex that inhibits the operation of other energy systems. Also, according to the document provided by Dr. Gunter Lange (Germany) - Senior Lecturer of the International Athletics Federation, we can clearly see the relationship

between the energy supply system, running distance, and time. The energy supply time is shown in Table 2.

Table 2: Energy systems for muscle performance at maximum exertion

Order	Energy system	Running distance	Delivery Time (Relative)
1	ATP - CP: Anaerobic without Lactac	30m	Approximately 1-3 seconds
2	ATP-CP	100m, 200m	Under 30 seconds
3	ATP-CP, LA	200m, 400m	30-90 seconds
4	Anaerobic glycolisis: Anaerobic pathway Lactac	400m	About 1 minute
5	AL, O_2	800m	90-180 second
6	O_2	1500m	Over 3 minutes
7	Aerobic glycolisis: Aerobic sugar	10.000m	From 30-40 minutes
8	Lipolysis: Burn fat in sufficient conditions oxy	20.000m	Over 1 hour

Note: According to Dr. Gunter Lange

Based on the contribution rates and delivery times of the energy systems as shown in Tables 1 and 2, we find sufficient time to assess endurance for middle-distance athletes. average and long must be 3 minutes or more and the main energy supply system is lactic acid and oxygen (800m run) and oxygen (1500m run).

2.4. Effects of physiological function on the development of endurance qualities

In sports activities, there are many factors affecting the index of endurance development such as psychological and physiological factors. In which physiological factors affecting the development of endurance are shown in the following aspects:

2.4.1. Maximum oxygen uptake (VO_2 max)

This indicator is greatly influenced by genetic factors. Based on the research results of foreign scientists in this field, the rate of genetic influence of VO_2 max accounts for over 80%. Because, in cyclic endurance sports, athletic performance is largely determined by how big or small the VO_2 max is. Therefore, VO_2 max is an important objective criterion to evaluate endurance qualities. Pulse rate VO_2 max (oxygen-pulse) reflects the economy for the functioning of the respiratory organs and the heart. [5]

Table 3: Age dynamics of VO_2 max and VO_2 max circuits of 13-16 year old athletes

Age	Maximum oxygen uptake (ml/min)		Pulse VO_2 max (ml/min)	
	Male	Female	Male	Female
13	2.440	2.119	12.2	11.3
14	3.550	2.360	17.6	11.9
15	4.850	2.660	19.7	13.2
16	5.100	2.710	24.7	14.0

Note: According to Dien Phong – China 1993 [5].

Through Table 3, we can see that, when the body is active, the natural development of the body's oxygen supply system at the age of 13-16 is not the same: the male's oxygen demand is higher. Females, males 2,440ml/min and increased to 5,100ml/min, while females increased from 2,119ml/min to 2,710ml/min. This metric reflects the VO2 max pulse, demonstrating improved economics of respiratory and cardiac performance. Also from Table 2, we show that the development of the body's oxygen supply system at the age of 15 - 16 has approached perfection. Because the body weight of males at the age of 15-16 increases dramatically, the maximum oxygen demand does not change much, which is the cause of the decline in endurance after this age.

2.4.2. Minute cardiac flow: the amount of blood that passes through the heart per unit time of minutes, which is the dynamic efficiency of the cardiac circulation

This factor is the most important factor to promote the body's working capacity and aerobic metabolism. The minute cardiac output is determined by changes in the quiescent conditions of the parasympathetic nerves, the thickening of the myocardium, and the magnitude of the cardiac chamber capacity. The size of the heart and each part of the heart is determined by age and level of exercise. The large cardiac capacity increases the amount of excess blood, and the thickening of the myocardium leads to an increase in the contractility of the myocardium and alters the balance of the sympathetic nervous system.[6]

Table 4: Natural adult growth index, cardiac capacity, age 13-16

Age	Absolute cardiac capacity (ml)		Relative cardiac capacity (ml)	
	Male	Female	Male	Female
13	461±10.2	482±11.9	57.1±1.81	53.4±1.88
14	516±14.9	517±17.1	60.4 ±1.58	54.6±2.25
15	583±12.3	542±10.9	64.3±1.90	60.4±3.16
16	660±14.7	580±11.2	67.2±2.48	65.2±5.41

Note: According to Dien Phong – China 1993 [5]

From Table 4, we can see that the heart capacity of males aged 15-16 increases very quickly, this is the cause of improving endurance capacity, and at the same time the nervous system is constantly improving.

Under normal conditions, the capacity of the lungs to expand is determined by the efficiency of using oxygen and from that, it is determined by the capacity of the gas exchange process and the working capacity of the body. The ability to expand the lungs is influenced by genetic factors relatively large. It has a very close relationship with VO_2 max. There are several indicators of the respiratory system that can reflect endurance training levels, and the development of these indicators also affects endurance development, such as vital capacity, volume maximal pulmonary ventilation, inspiratory reserve, and inspiratory capacity.

2.4.3. Lung expansion capacity

In normal conditions, lung expansion capacity is determined by oxygen utilization efficiency, and from there it is determined by gas exchange capacity and the body's working capacity. Body, the ability to expand the lungs is influenced by genetic factors relatively large. It has a very close relationship with VO_2 max. [6]

3. Conclusion

The age of 15-16 is the age of strongest physical and mental development, a favorable period for the formation of skills, motor skills, and the development of general physical qualities as well as endurance. in particular. Physiologically favorable conditions are the complete development of all functional systems of the body. Psychologically, the outstanding feature of boys of this age is the awareness of their role and status in society, awareness of the profession they have chosen, from which they have the effort to train their will, overcome difficulties, and fatigue in endurance education to achieve their intended goals.

Conflict of Interest Statement

The authors declare no conflicts of interests.

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