ISSN: 0975-766X
CODEN: IJPTFI
Available Online through *Research Article*
www.ijptonline.com

MODELING OF EDUCATIONAL AND TRAINING PROCESS OF ATHLETES OF 12-14 YEARS BASED ON THE MORPHO-FUNCTIONAL INDICATORS

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Received on 15-07-2016 *Accepted on 10-08-2016*

Abstract

A characteristic feature of modern sport is significantly extensive and intensive training loads, which impose extremely high demands on the athlete's body. Training sessions are often conducted against chronic fatigue. Frequent physical overload leads to overstrain of the locomotor apparatus and to various prepathological and pathological conditions. This occurs in cases where the organization of the training process does not meet the scientific requirements and the load does not match the age and individual abilities of an athlete.

Analysis of the relevant scientific and methodological literature has revealed that there are contradictions between the health level of the younger generation and the achievement of high results in sport. Objective of the study was to determine the effectiveness of modeling the training process, taking into account the physiological characteristics of athletes. It is proposed to experimentally prove the effectiveness of modeling the training process of athletes based on their individual physiological characteristics.

During the experiment, we concluded that the use of methods of modeling the training process of athletes on the basis of their morpho-functional indicators has positive effect on the athlete's development.

Keywords: training process, modeling, physical development, morpho-functional indicators.

Introduction

Recently, there was observed a significant decline in health, physical development and motor fitness of children, which in turn prevents the qualitative selection for entering the children and youth schools. According to the Federal State Statistics Service, the incidence of the basic diseases has increased significantly among the Russian population. In 2000, the incidence in the population amounted to 106,328 thousand people, in 2008 this figure amounted to 109,590 thousand people, and in 2013 reached 114,721 thousand people. Preventive examinations of children under 14 years old have revealed in 2013: a decrease in hearing acuity - 32.2 thousand people; a decrease in visual acuity - 1122.7 thousand people; speech defects - 709.3 thousand people; scoliosis - 247.3 thousand people; postural disorder - 1200.1

thousand children. Training sessions are often conducted against chronic fatigue. Frequent physical overload leads to overstrain of the locomotor apparatus and to various pre-pathological and pathological conditions. This occurs in cases where the organization of the training process does not meet the scientific requirements and the load does not match the age and individual abilities (features) of an athlete [1,2]. Training of athletes is a versatile and complex pedagogical process, which consists of three interrelated components such as teaching, training, and education. The aim of this process is to ensure the development and improvement of knowledge, abilities, motor skills and qualities necessary for mastering the technique of an athletic exercise and achieving results provided for by the plan and program. The management effectiveness of training process is closely associated with the simulation - use of models in order to determine various characteristics of sports training and rationalize the methods of designing its structural parts.

KuramshinIu.F. gave the following definition of sport training: it is an integral part of the athlete's training. It is a pedagogically organized process of athletic improvement, aimed at the development of certain qualities, abilities and the formation of the necessary knowledge, skills and abilities that determine the athlete's readiness to achieve the best results in a certain type of sports activity [3,4].

Athletic improvement in the process of training involves the use of a whole set of training and extra-training factors that ensure directional influence on the development of the athlete and, ultimately, increase its level of performance (fitness), i.e. adaptability of the organism to a specific activity.

According to KuramshinIu.F., the aim of sports training is to achieve the maximum possible for the athlete's level of training based on the specifics of competitive activity and ensuring demonstration of the planned sport results in important competitions [3,4].

KholodovZh.K. wrote that in the course of designing a sports training, the integrity of the training process is ensured on the basis of a specific structure, which is a relatively stable order of combining the components (subsystems, parties and individual units), their regular relation to each other, and the general sequence [5].

Modelling can be carried out in various forms:

1. Information descriptive models, representing a verbal description of the original.
2. Graphical models - representation of the original in the form of graphs, charts, drawings.
3. Subject models - layouts, chips, etc., representing, for example, the arrangement of players to learn tactical variants.
4. Logic models - provide a description of the process logic;

5. Physical models, predetermining the interaction of an athlete in a situation similar with the future competition or his/her confrontation with the original of his/her opponent.
6. Mathematical models using the description of the process or object with the help of mathematical formulas, systems of equations and inequalities.
7. Cybernetic models - the same but with the use of computers, and computer simulation [5].

The models used in practicing both training and competitive activities can be divided into three levels: generalized, group, and individual. However, the modeling process is not applied in practice at the stage of athletic specialization [5]. We should note that physical development plays a major role in the design of the training process.

The term "physical development" usually means a set of functional parameters that determine the reserve of the physical forces of the body. The concept of physical development should be expanded through the evaluation of the growth and development processes of the organism. The main criteria of physical development include: the length of the body; body mass; chest circumference; and vital capacity. However, the assessment of physical development considers not only these somatic values (*soma* - body), but also the results of physiometric measurements (hand grip, back lift) and somatoscopic indicators (the development of the musculoskeletal system, blood filling, sexual development). Therefore, there is no doubt that physical development is one of the development of the individual and is a biological process, determined by both environmental and genetic factors. Each age period has its own specific features that should be primarily considered in the design of the training process [6, 7, 8, 9, 10, 11].

Research organization methods

To solve the above problems, the following methods were used: analysis of scientific and methodical literature; testing of morpho-functional indicators; and methods of mathematical statistics.

Physical development of the subjects was assessed with the use of anthropometric indices:

Body length - increase in size and weight of the developing organism. This was measured with a wooden stadiometer accurate to 0.5 cm. Body weight. Weighing was performed on the medical weighing machine accurate to 50 g.

Hand grip strength (dynamometry). Used to determine the compressive strength of finger bending muscles of both hands of a person, as well as to diagnose the state and function of the arms. Both the strength and the strength moment is measured in people with the use of a dynamometer.

Vital capacity (spirometry) - the maximum amount of air that lungs can hold after a maximal expiration.

Heart rate - jerky vibrations of the arterial walls associated with heart cycles (the number of heart beats per minute). Heart rate is determined by pulsometry at rest for 1 minute. Hemoglobin is a protein found in red blood cells and carrying oxygen exchange between the lungs and body tissues. This laboratory test involves measurement of the amount of hemoglobin - the protein found in red blood cells that carries oxygen to the tissues and organs, and carbon dioxide - from the tissues and organs to the lungs where it is exhaled [12].

All measurements were performed with the standard tools in compliance with a unified methodology. Mathematical and statistical processing: to restore significant differences between stages, the average value was used. Data processing was carried out with the use of Microsoft Excel environment.

Organization of research - the study was carried out in several stages, and involved teenagers engaged in athletics in the Municipal State Institution for Additional Education of Children, Children and Youth Sports School "IarChally", city of Naberezhnye Chelny. The study involved teenagers (13-16 years old) including 13 boys and 7 girls. It was conducted in November 2013, in April and in November 2014, and in April 2015.

Upon making the training-course schedule, we studied personal performance of athletes: physical development, physical fitness and the results of competitive activity. The training-course schedules were developed for the period of three years, as well as models for each athlete. This athletics program is designed for work with children of 12-13 years old of the educational and training group. Educational and training activity is rated for 46 weeks and 6 weeks in a sport and fitness camp and based on individual plans of students, for the period of their active rest, while the ratio of hours provided for the main preparation activities is correct. Number of hours per week is 12 hours, classes are conducted 6 times a week for 2 hours each [13]. The basis of the study was an experiment that had been conducted throughout a year. Health care professionals were checking a health status of the subjects, since the experiment was performed under the supervision of doctors.

Results and Discussion

One of the indicators of the functional state of the organism is the level of physical performance that varies with age. In addition, physical performance also depends on the level of physical development [14, 15]. Therefore, prior to determining physical performance it is advisable to determine the physical development of the test subjects.

We determined changes in the physical development of our athletes by the following anthropometric parameters: body length and weight. Body length is the main indicator of physical development, which is the basis for an accurate evaluation of body weight. At the first stage we found the body length of the subjects to be 160.55 ± 12.84 cm, at the

second stage it was 163.11 ± 11.98 cm, so, an increase over the period was 2.56 cm. At the third stage we recorded 164.96 ± 11.58 cm, at the fourth stage - 167.7 ± 10.77 cm. An increase during the entire experiment was 7.15 cm.

Body weight in male athletes at the first stage was 49.46 ± 15.69 kg, at the second stage this indicator was 50.57 ± 15.54 kg. An increase over this period was 1.11 kg. At the third stage we obtained the following results - 52.43 ± 16.12 kg, the body weight of adolescents at the fourth stage was 55.64 ± 16.6kg. An increase during the entire experiment was 6.18 kg.

To prove the relation between body weight and body length we used the Quetelet index (or body mass index). At the first stage the obtained results were 18.8 ± 3.48, at the second stage - 18.92 ± 3.49. At the third stage we obtained 19.02 ± 6.39, and at the fourth stage - 19.51 ± 4.30. The results are standard for each age period.

Analysis of the female subjects revealed the following results: at the first stage the body length of the subjects was 159.38±5.09 cm, at the second stage it was 161.8±3.97 cm, so, an increase over the period was 2.41 cm. At the third stage we obtained 163.12 ± 3.62 cm, at the fourth stage - 164.35 ± 3.53 cm. An increase during the entire experiment was 4.97 cm. The results are shown in Figure 3.

Body weight in athletes at the first stage was 47.4±8.67 kg, at the second stage this indicator was 48.90±7.59 kg. An increase over this period was 1.5 kg. At the third stage we obtained the following results - 49.5 ± 4.42 kg, the body weight of teenagers at the fourth stage was 51.40 ± 3.24 kg. An increase during the entire experiment was 4 kg. Data are shown in Figure 4.

When considering the body mass index in girls during the experiment we found that the first stage the obtained results were 18.8 ± 3.48, at the second stage - 18.92 ± 3.49. At the third stage we obtained 19.02 ± 6.39, and at the fourth stage - 19.51 ± 4.30. The results are standard for each age period.

During the experiment, we also studied morpho-functional indicators of the athletes.

Vital capacity (spirometry) is an indicator of the functionality of the respiratory system in athletes. At the first stage, the athletes showed the following results - 2,558.3 ± 771.53 cm^3, at the second stage this indicator was 2,876.38 ± 760.93 cm^3. An increase between the first and second stages was 318.07 cm. At the third stage we obtained 3,014.07 ± 748.12 cm^3, at the fourth stage athletes showed 3,269.61 ± 872.96 cm^3. An increase during the entire experiment was 711.31 cm^3. Data are shown in Figure 5.

Hemoglobin is a protein found in red blood cells and carrying oxygen exchange between the lungs and body tissues. The higher its blood level, the more oxygen our body receives and the better operates. At the first stage of our

experiment, the athletes showed the following results - 137.84 ± 10.27 g/l, at the second stage - 139.76 ± 10.98 g/l. An increase between the first and second stages was 1.92 g/l. At the third stage we obtained 153.46±15.49 g/l, at the fourth stage - 152.69±9.23 g/l. An increase during the entire experiment was 14.85 g/l. The results of right hand grip strength of the athletes at the first stage were 32.30±8.93 kg, at the second stage - 28.46±9.08 kg. An increase between the first and second stages was -3.84 kg. At the third stage, the athletes showed 30±8.90 kg, and at the fourth stage - 33.61±8.46 kg. An increase during the entire experiment was 1.31 kg.

The results of left hand grip strength of the athletes at the first stage were 29.38±7.76 kg, at the second stage - 25.38±9.35 kg. An increase between the first and second stages was -4 kg. At the third stage we obtained 28.30±8.75 kg, at the fourth stage - 31.07±8.36 cm. An increase during the entire experiment was 1.69 kg.

Heart rate at rest at the first stage was 74.30±7.15 bpm, at the second stage - 70.07±6.17 bpm, an increase between these stages was 4.23 bpm. At the third stage we obtained 75.83±8.14 bpm, at the fourth stage - 74±6.63 bpm. An increase during the entire experiment was 0.30 bpm. Data are shown in Figure 8.

At the first stage, vital capacity of the female athletes was 2,471±274.74 cm^3, at the second stage this indicator was 2582.57±583.5 cm^3. An increase between the first and second stages was 111.57 cm. At the third stage we obtained 2,803.42±326.19 cm^3, at the fourth stage athletes showed 2,945.71±447.11 cm^3. An increase during the entire experiment was 474.71 cm^3. Data are shown in Figure 9.

The results of right hand grip strength of the athletes at the first stage were 32.30±8.93 kg, at the second stage - 28.46±9.08 kg. An increase between the first and second stages was -3.84 kg. At the third stage, the athletes showed 30±8.90 kg, and at the fourth stage - 33.61±8.46 kg. An increase during the entire experiment was 1.31 kg.

The results of left hand grip strength of the athletes at the first stage were 29.38±7.76 kg, at the second stage - 25.38±9.35 kg. An increase between the first and second stages was -4 kg. At the third stage we obtained 28.30±8.75 kg, at the fourth stage - 31.07±8.36 cm. An increase during the entire experiment was 1.69 kg.

Heart rate at rest at the first stage was 76.28±11.33 bpm, at the second stage - 67.71±5.7 bpm, an increase between these stages was 8.57 bpm. At the third stage we obtained 78±9.34 bpm, at the fourth stage - 73.71±4.53 bpm. An increase during the entire experiment was 2.57 bpm.

Summary:

Based on the analysis of scientific literature, we found that a great importance in studying the age characteristics is given to morpho-functional and anthropometric indicators, as their values determine physical development and health.

This age is characterized by a rapid growth of the body, all organs and tissues. Stormy growth rate is due to the influence of sex hormones and thyroid hormone. In adolescence, the individual features of the body proportions and the visual appearance of the person are formed.

During training, the athletes show positive dynamics in the development and operation of basic vital organs and systems: blood viscosity decreases, the level of hemoglobin increases, heart rate decreases, breathing becomes slower and deeper, and cardiac activity becomes more economical.

Achieving high results requires development and simulation of training process of athletes, identification of an optimal training program, subject to the level of fitness, age, sports qualification, training experience, table of events, and features of a certain kind of sport.

Conclusion: Analyzing the scientific and methodological literature on the topic of our research, we have developed and tested a model of training process for athletes based on individual level of physical development of each athlete.

Our study involved teenagers of 13-16 years old engaged in athletics in Children and Youth Sports School "IarChally", city of NaberezhnyeChelny.

Based on the analysis of this group of teenagers, and subject to the specific changes in physical parameters, we modeled the program for more effective management and development of the physical qualities of athletes. Modeling is based on anthropometric data, morpho-functional indicators, level of physical fitness, and the performance in athletic activities.

We approbated these models within the framework of the pedagogical experiment. To study the effect of this technology on the dynamics of physical development in athletes, we have defined the initial level of physical development in athletes, and further analyzed the dynamics at the end of the experiment. At the end of modeling the training sessions, by the end of the study, the experimental group showed significant changes in their physical development and physical fitness. Positive dynamics is also observed in the performance of sports categories. An increase in all indicators for the period of study indicates the positive influence of modeling the training process on the result and confirms the hypothesis of our study. We concluded that the use of methods of modeling the training process of athletes has positive effect on the athlete's development, which in turn helps in achieving athletic results.

Acknowledgements

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

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