The Integrated Technique of the Rating of Motor Abilities of Sprinters at the Stage of Initial Sports Specialization

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Summary
The article discusses problems of sports selection of prospective children in track and field athletics. The article presents results of a longitudinal study of athletic sprinters in the age range of 12–14 years.

The research goal is to provide a scientific basis for predicting motor abilities of sprint athletes at the stage of initial sports specialization.

The object of research – educational and training process of short distance runners at the stage of initial sports specialization.

The specific scientific methodology of this study is presented by research methods that provide reliable empirical material and its primary processing (analysis of scientific and methodological literature, questionnaires, anthropometric measurements, control and pedagogical tests, assessment of biological maturity, methods of psychophysiological testing, dermatoglyphic method, method of expert evaluation, methods of mathematical statistics).

For the first time, a complex method of predicting the motor abilities of young runners at short distances was developed and tested. For the purpose of revealing the effectiveness of the developed method, a formative pedagogical experiment was carried out, in which 40 runners for short distances (boys) aged 12 years with normal rate of biological maturation took part. The study was conducted at the “Burevestnik-73” Children’s and Youth Education and Training Center (Vitebsk) and Children and Youth Sports School of Olympic Reserve № 2 of the Belarusian Physical Culture and Sports Society “Dynamo” (Minsk).

According to the results of performances during the season 2018–2019 it was noted that the majority (72.56%) of winners and medalists of town, regional and national competitions are athletes from the experimental group with an assessment of the prospects of “above average”, “high”, while sprinters with an assessment of the prospects of “average”, “below average” and “low” in this number were not included.

The results of the pedagogical experiment demonstrated the effectiveness of this method. It was noted that an objective assessment of the prospects of young athletes can be obtained only on the basis of comprehensive studies.

Keywords: sports selection; longitudinal research; athletics-sprinters; children’s sports; methods of predicting motor abilities.

Introduction
Research problem. In sport practice there are a lot of examples, when athletes use a modern effective training methodology, but cannot achieve good results. Specialists notice that for the achievement of outstanding results it is not enough for an athlete to follow a well-organized long-term training process with carrying out considerable by volume and intensity training workload, for this purpose an athletic talent is also required, and for the establishment of the world record it is necessary to have athletic genius (Сергиенко, 2004).

The problem of the forecast of motor abilities is especially actual in sprint where one of the main factors, limiting sports results, is the level of speed development. It is established that among all motor abilities, high-speed qualities are the main subject to genetic control (Ives, 2018). It testifies stability of person’s inborn abilities and the possibility of their forecast, which is reliable enough.

The stage of initial sports specialization (12–14 years) should be considered as the most important and responsible in the course of long-term sports preparation of young runners on short distances (Haugen et al., 2019). The optimum period to develop the elementary forms of speed for boys is the age of 7–9 and 13–16 years (Way et al., 2016).

However, despite considerable experience and active research, the problem of predicting motor ability is underdeveloped (Gonçalves et al., 2012; Libertus, Hauf, 2017). As the results of researches show, the accuracy of the forecast of athletic success does not exceed 40–50% (Сологуб, Таймазов, 2000). Besides, the research available in this area in
most cases have unilateral character: pedagogical, psychological, genetic.

Thus, it is possible to ascertain presence of the important scientific problem decision of which is connected with the necessity to develop an accessible, informative complex technique of an estimation of sprinters’ motor abilities at a stage of initial sports specialization.

**Object of research**: prognosis of motor abilities of athletes-sprinters at the stage of initial sports specialization.

**The aim of the research** was a scientific substantiation of forecasting motor abilities of athletic sprinters at the stage of initial sports specialization.

**Research tasks**:
1. To reveal the dynamics of the increase of various indicators, which show up prospective young sprinters at a stage of initial sports specialization.
2. To establish the most informative indicators for showing up perspective young sprinters at a stage of initial sports specialization.
3. To develop and prove experimentally the efficiency of the integrated technique of the rating of motor abilities of sprinters at the stage of initial sports specialization, taking into account the most informative indicators, which show up prospective young athlete.

The research was conducted according to the plan of the research work of the establishment of education “Belarus state university of physical training”: area II “The perfection of the preparation system of highly skilled athlete and the preparation of a sports reserve”; problem 2.3. “The scientific substantiation of construction and the maintenance of training process”; topic 2.3.3. “Development of training and competitive activity of athletes”, and also within the limits of the Government program of physical training and sports development in Belarus: “The increase of selection during the formation of a sports reserve with the maximum orientation to individual inclinations and abilities of athlete”.

**Methodology**

**Research organization.** Scientific research was carried out in three stages. The scheme of the organization of research is presented in Fig.1.

**Research sample.** A questionnaire survey was also attended by 65 coaches. The survey including a dermatoglyphic analysis has been carried out on highly qualified track and field athletes (MSC, MS and ISM) involved in sprinting, at the age of 18–26 years. In total, 15 people were tested. The purpose of this study was to identify dermatoglyphic indicators that mark a predisposition to the development of high-speed ability.

The experiment involved 40 short distance runners (boys) aged 12 years with a normal rate of biological maturation. The research was conducted on the basis of Children’s and Youth Sports School of Olympic Reserve “Burevestnik-73” (Vitebsk) and Children’s and Youth Sports School of Olympic Reserve No 2 of the Belarusian Physical Culture and Sports Society “Dynamo” (Minsk).

**Research instrument.** Anthropometric measurements, control and pedagogic tests, the rating of biological maturity, the methods of psychophysiologic testing, a dermatoglyphic method, the method of expert estimations, a pedagogical experiment, the methods of mathematical statistics.

**Questionnaire.** In order to generalize the experience on selection and forecasting of motor abilities of athletes, we conducted a questionnaire survey among coaches on different types of athletics.

**Anthropometric measurements:**

The length of the body was measured by the anthropometer Martin (accuracy up to 0.2-0.3 cm). In order to measure the body length correctly, a number of requirements were met: the measured barefoot was placed on the horizontal platform of the rostomer with its back to its vertical stand with freely lowered arms, well-drawn feet and maximally extended knees, touching the rostomer’s stand with five points: heel, shin, buttocks, back surface between the blades (Hauspie, Cameron, Molinari, 2004).

The weight of the body was determined on scales with an accuracy of 50 g. The following method was used to measure the circumference of the chest: the measuring tape was applied directly at the corners of the scapula from behind, at the level of the median chest point from ahead. When applying the tape, the examinee was asked to raise his or her arms slightly, then lower them and stand in the main post. Measurements were taken with normal, calm breathing (Yorkin M., Spaccarotella K, Martin-Biggers J., Quick V., Byrd-Bredbenner C., 2013).
Observed pedagogic experiment

Under test
Sprinters at the age of 12-14 years - 80 people, at the age of 18-26 years (the candidate for the master of sports (CMS), the master of sports (MS), the master of sports of the international class (MSiC))

The contents of the research
The integrated testing of indicators of physical development, rates of biological maturing, physical fitness, psycho motility and dermatoglyphic analysis of sprinters of various qualification

The handling of the results
The comparative, correlated analysis

The result
The revelation of the dynamics of increase rates of various indicators, which show up perspective young sprinters at a stage of initial sports specialization.

The establishment of the most informative indicators, which define the level of perspective qualities of young sprinters

Formative pedagogic experiment

Under test
12-year old sprinters with normal rate of biological maturing

Experimental group – 14 people
Control group – 26 people

The contents of the research
Research on the basis of the program “Track and field athletics (sprint) for specialized sports institutions and schools of the Olympic reserve” with integrated testing of indicators of high-speed, speed abilities, the rates of their increase, the time of simple visually-motor reaction, the quantity of curls of fingers on both hands, the index of weight and growth, the rates of biological development of sprinters for definition their perspective qualities

The handling of the results
The comparative analysis

The result
The forming of sports groups is on basis of the estimation of perspective qualities of young sprinters at a stage of initial sports specialization

The interpretation of the received data, the formulation of conclusions, working out practical recommendations, writing and formalization the article

Fig 1. The scheme of the organization of research
Body mass index (BMI). Body Mass Index is a simple calculation using a person’s height and weight. The formula is BMI = kg/m² where kg is a person’s weight in kilograms and m² is their height in meters squared (Zierle-Ghosh, Jan, 2018).

Pedagogical tests:
30 meters flying start. Set up cones at 0, 20 m and 50 m along a straight line, and timing gates at 20 m and 50 m. The test involves a 20 m acceleration area to enable the runner to get up to their maximum speed, then maximal sprinting over 30 meters. The tester should provide hints for maximizing speed and encourage them to continue running with maximum effort past the finish line. Two trials are allowed, and the best time is recorded to the nearest two decimal places. The timing starts from when the athlete’s torso passes through the first timing gate, when they pass the 20 m cone, and finishes at the 50 m cone marker (Freeman, 2014).

Standing long jump. This test is performed on a marked jogging track. From the original standing position, the feet together or slightly apart, the toes in line with the starting line, jump forward at the maximum possible distance. The person preliminarily bends his legs, pulls his hands back, tilts his torso forward, shifts the center of gravity of the body forward and jumps two legs with a wave of arms forward. The countdown is on the heel, which is closer to the point of pushing. The length of the jump with two legs in centimeters (cm) is determined. There are three attempts in a row, the best result is counted (Coulson, Archer, 2015).

The increase in fitness scores from one test to another was determined by the formula proposed by Broudy (Сирис, Гайдарская, Рачев, 1983) (Formula 1):

\[ W = \frac{V_2-V_1}{\sqrt{2V_1V_2}} \times 100\% \]

where \( W \) is the growth rate;
\( V_1 \) and \( V_2 \) are the initial and final results in control tests, respectively.

Psychophysiological testing. For the registration of psychophysiological indicators the hardware and software complex “NS-PsychoTest” produced by Neurosoft was used.

To evaluate the functional state of the Central Nervous System (CNS) we used data from the Simple Visual Motor Reaction (SVMR). Test method: a light signal is given to the tested person at random intervals. It is offered to react as soon as possible by pressing a button. The interval between giving the signal and starting the reaction is the reaction time (Лоскутова, 1978).

Dermatoglyphic method. Dermatoglyphics is a science that studies the details of the relief of the skin of palms and feet of man.

When determining the type of finger patterns, the printing ink method was used. A few drops of ink were applied on glass and evenly rolled out with a rubber roller (photographic roller). The painted roller was applied to the fingers of the investigated athlete. In advance a sheet of A4 size writing paper was prepared (surname, first name, patronymic). On this sheet the test subject’s fingers (from thumb to little finger) were applied one by one, rolling them from left to right. For this purpose we took the subject’s relaxed fingers with our right hand and rolled them on a sheet of paper. If the fingerprint was of poor quality, the procedure was repeated. The main thing is that the deltas (triradii) which determine the type of finger drawing, are clearly visible on the print.

The following dermatoglyphic parameters were determined:

Patterns on distal phalanges of fingers:
- arch – A (idle pattern) is characterized by the absence of a triradius (a triradius is a place or point where the three differently directed systems of papillary lines converge) or delta and consists of ridges that cross the finger pad;
- loop – L (single-delta pattern) has one triradius or delta. It is a semi-closed pattern in which the skin scallops start from one edge of the finger, bend distally to the other, but without reaching it, return to the one from which they originate;
- Whorl – W (double-delta pattern) has two triradii or deltas. The center of the whorl pattern may look like a circle, the letter S or a spiral (Sharma, A., Sood, Singh, Sharma A., 2018).

Biological maturity assessment. Biological age was calculated on the basis of secondary sexual characteristics, and the passport age was determined according to standards accepted in medical practice, for example, when 12 years old includes children from 11 years 6 months to 12 years 5 months 29 days. To 13-year-olds – from 12 years 6 months to 13 years 5 months 29 days, etc.
When working with young athletes, the most common technique is one that takes into account the degree of pubic and armpit hair in boys. The degree of hair salvation is descriptive and is reflected in points (Table 1).

<table>
<thead>
<tr>
<th>AGE</th>
<th>SIGNS</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>P0 Ah0</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>P0 Ah0 or P1 Ah0</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>P2 Ah0 or P1 Ah1</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>P3 Ah0 or P3 Ah1</td>
<td>3-4</td>
</tr>
<tr>
<td>15</td>
<td>P3Ah2 or P4 Ah2</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>P4 AH3</td>
<td>6</td>
</tr>
</tbody>
</table>

Biological maturity is assessed as follows:
1) pubic hair (Pn): P0 – no hair loss; P1 - single hair; P2 – rare hairs concentrated at the root in the central part of the pubis; P3 – thick but straight hairs are located along the whole surface of the pubis, without clear boundaries; P4 – for thick curly hair, evenly distributed over the entire pubic area as a triangle; P5 – for thick curly hair extending to the inner thighs and from pubic to navel (male hair type).
2) Ampithermal hair (Ax): Ah0 – absence of hair; Ah1 – single straight hair; Ah2 – the central area of the armpit basin is densely concentrated straight hair; Ax3 – straight hair is densely located all over the armpit basin; Ax4 – curly hair all over the armpit basin.

The results of the examination are recorded in the so-called “sexual formula”, in which at the base of the symbol is marked by the stage of development of the characteristic. For male teenagers it is a formula – Rn, Ax (Xariotonova, Gorska, 1997).

**Expert evaluation method.** There are several ways of conducting expert reviews. One of them is ranking, i.e. determination of relative importance of objects of expert evaluation on the basis of ordering (Efimenko et al., 2019).

To implement the procedure of expert evaluation it was necessary to form a group of experts. The general requirement for the formation of the group of experts was the effective solution of the expert evaluation problem.

Ranking consists of ranking the indicators in the order of their preference by their importance or weightiness. The place occupied by this ranking is called the ranking. The higher the rank, the more preferable is the object, the more important is the indicator.

The purpose of the ranking was to determine the weight factor for eight indicators influencing the sports result of the sprint athletes at the stage of initial sports specialization. The weight factor is an index characterizing the degree of importance of a separate index in the total sum.

At a large number of estimated factors their “distinguishability”, from the point of view of the expert, decreases. Therefore, the number of factors should not exceed 20, and the greatest reliability of the ranking procedure is provided at n < 10.

The weight factor qi is determined by the Formula 2:

\[ qi = \frac{ai}{\sum ai}, \]

where qi is the weight factor; ai – the sum of points assigned by all experts on the i-th indicator; \( \sum ai \) – the sum of points awarded by all experts on all indicators.

The degree of consistency of the experts’ opinions is characterized by the concordance coefficient W. The coefficient of concordance W is calculated using the Formula 3:

\[ W = \frac{12 \times \sum S^2}{n^2 \times (m^3 - m)}, \]

where \( \sum S^2 \) is the sum of squares of deviations of the sum of ranks of each subject of examination from the arithmetic mean; n – number of experts; m – number of indicators.

In the case of W < 0.2–0.4, it is said that there is a weak consensus of experts, and large values of W > 0.6–0.8 indicate a strong consensus of experts. Weak consistency is usually the result of the following reasons: 1) in the group of experts under consideration there is really no commonality of opinions; 2) there are coalitions with high coherence of opinions within the group, but the generalized opinions of coalitions are opposite (Jeteseva, 2003).

**Methods of mathematical statistics.** The following statistical indicators were used in the work:

- r – Spearman correlation coefficient, U – Mann-Whitney criterion, Wilcoxon criterion.
Spearman Rank Correlation Coefficient is a non-parametric analogue of Pearson’s classical correlation coefficient, but in its calculation not the distribution-related indicators of the compared variables (arithmetic mean and dispersion) are taken into account, but ranks.

Mann-Whitney U criterion was chosen according to the algorithm of criterion selection for comparison of independent small samples. For paired-dependent samples (test results of the same group) the Wilcoxon criterion of paired comparisons was used.

In descriptive statistics, a set of position measures was calculated: arithmetic mean, standard (square) deviation as parameters allowing to estimate features of a certain sample.

Mathematical processing of data was carried out with the help of a computer using the STATISTICA 6.0 program according to the generally accepted method.

**Research results and discussion.**

The results of the poll of coaches have shown that the reasons of low accuracy of the forecast of motor abilities of young athletes are: the absence of intuition, a lack of physiological and psychological knowledge.

The considerable part of coaches uses rather narrow set of techniques, as a rule, it is pedagogical supervision, a conversation, a poll, pedagogic tests. However for the increase of accuracy of the forecast the majority of experts consider it necessary to use a complex of methods.

The results of ascertaining pedagogical experiment have shown that at the age of 12–14 the features of sprinters are inherent. Runners on short distances at the age of 12–13 years are characterized by the greatest increase of indicators of speed abilities. At the same time the reduction of time of simple visually-motor reaction (SVMR) is observed. At the age of 13–14 the indicators of physical development, high-speed abilities and high-speed endurance increase. The tendency to quantity increase of overgrown teenagers during the period from 12 till 14 is revealed (with 15.79 to 67.13%) (Баранаев, 2013).

A dermatoglyphic test among sprinters of various qualifications has been held (I youthful, II, III category, the candidate for the master of sports (CMS), the master of sports (MS), the master of sports of the international class (MSIC)). In drawing 2 the basic types of manual patterns are presented.

The analysis of the received data has shown that there are authentic distinctions between sprinters-rated sportsmen and the sprinters of high qualification on the indicator of quantity of whorls on fingers of both hands (drawing 2) (Баранаев, 2014) The data obtained coincides with the research presented by L.P. Sergienko (Сергиенко, 2013).

The analysis of correlation interrelation between the indicators of physical development, physical readiness, the rates of biological maturing, a psychomotility, dermatoglyphicy has allowed to establish that at a stage of initial sports specialization of sprinters there are close correlation interrelations (p <0.01–0.05) between indicators of physical readiness and physical development (r = 0.54–0.77).
Also a considerable influence on the level of physical readiness renders an indicator of the rate of biological maturing (r = 0.46–0.78 at p < 0.01–0.05). Besides, with the increase of the sports category the value of indicators of physical development decreases, but the value of indicators of psychomotility and dermatoglyphy increases, i.e. the more the level of proficiency of sprinters increases, the bigger role start to play the congenital inclinations.

By the results of ascertaining pedagogic experiment the most informative indicators are revealed (the index of weight and growth, the degree of the pilosis of a pubis and an axillary hollow, the quantity of curls on fingers of both hands, the time of simple visually-motor reaction, the result in 30 meters flying start, the rates of an increase of results in 30 meters flying start, the result in a standing long jump, the rates of an increase of results in standing long jump), which define the level of perspective qualities of sprinters.

On the basis of the received data experimental pedagogic preconditions have been formulated and the complex technique of the estimation of motor abilities of sprinters at a stage of initial sports specialization has been developed, taking into account the most informative indicators defining perspective qualities of young athletes.

For the purpose of definition the factor of weightiness for the informative indicators, which define the level of perspective qualities of young sprinters at a stage of initial sports specialization, the expert estimation has been held by a ranging method. The poll was carried out with the distinguished coaches of Belarus which have acted as experts.

For each indicator has been developed the mark scale of estimation of perspective qualities of sprinters at the stage of initial sports specialization for training groups of the first year of training and the second year (Table 2).

**Table 2**

<table>
<thead>
<tr>
<th>Stages</th>
<th>Rates</th>
<th>The mark in points</th>
</tr>
</thead>
<tbody>
<tr>
<td>The first Training groups 1 year of training, preparatory period (September)</td>
<td>Speed abilities (30 meters flying start, s) &gt;3.10</td>
<td>4.1–4.10 3.80–3.99 3.60–3.79 &lt;3.60</td>
</tr>
<tr>
<td>The first Training groups 1 year of training, preparatory period (September)</td>
<td>The rates of biological maturing, points* 1</td>
<td>2 3</td>
</tr>
<tr>
<td>The first Training groups 1 year of training, preparatory period (September)</td>
<td>The index of weight and growth, g/cm &lt;236 236–244 245–253 254–269 &gt;269</td>
<td></td>
</tr>
<tr>
<td>The first Training groups 1 year of training, preparatory period (September)</td>
<td>The abilities of speed and power (standing long jump, cm) &lt;161 161–177 178–202 203–219 &gt;219</td>
<td></td>
</tr>
<tr>
<td>The first Training groups 1 year of training, preparatory period (September)</td>
<td>SVMR, ms &gt;233 211–233 201–210 177–200 &lt;177</td>
<td></td>
</tr>
<tr>
<td>The first Training groups 1 year of training, preparatory period (September)</td>
<td>The quantity of whorls on fingers of both hands 0–2 3–4 5–6 7–8 9–10</td>
<td></td>
</tr>
<tr>
<td>The second Training groups 1 year of training, emulative period (May-June)</td>
<td>Speed abilities (30 meters flying start, s) &gt;3.90</td>
<td>3.80–3.90 3.60–3.79 3.40–3.59 &lt;3.40</td>
</tr>
<tr>
<td>The second Training groups 1 year of training, emulative period (May-June)</td>
<td>Speed abilities (the increase of results in 30 meters flying start, %) &lt;0.86</td>
<td>0.86–3.50 3.51–9.47 9.48–13.83 &gt;13.83</td>
</tr>
<tr>
<td>The second Training groups 1 year of training, emulative period (May-June)</td>
<td>The rates of biological maturing, points 1</td>
<td>2 3</td>
</tr>
<tr>
<td>The second Training groups 1 year of training, emulative period (May-June)</td>
<td>The index of weight and growth, g/cm &lt;257 257–285 286–299 300–339 &gt;339</td>
<td></td>
</tr>
<tr>
<td>The second Training groups 1 year of training, emulative period (May-June)</td>
<td>The abilities of speed and power (standing long jump, cm) &lt;161</td>
<td>161–180 181–209 210–229 &gt;229</td>
</tr>
<tr>
<td>The second Training groups 1 year of training, emulative period (May-June)</td>
<td>The abilities of speed and power (the increase of results in standing long jump, %) &lt;0.41</td>
<td>0.41–5.00 5.01–11.29 11.30–15.89 &gt;15.89</td>
</tr>
<tr>
<td>The second Training groups 1 year of training, emulative period (May-June)</td>
<td>SVMR, ms &gt;233</td>
<td>211–233 201–210 177–200 &lt;177</td>
</tr>
<tr>
<td>The second Training groups 1 year of training, emulative period (May-June)</td>
<td>The quantity of whorls on fingers of both hands 0–2</td>
<td>3–4 5–6 7–8 9–10</td>
</tr>
<tr>
<td>The third Training groups 2 year of training, emulative period (May-June)</td>
<td>Speed abilities (30 meters flying start, s) &gt;3.80</td>
<td>3.70–3.80 3.50–3.69 3.30–3.49 &lt;3.30</td>
</tr>
<tr>
<td>The third Training groups 2 year of training, emulative period (May-June)</td>
<td>Speed abilities (the increase of results in 30 meters flying start, %) &lt;3.86</td>
<td>3.86–8.46 8.47–14.75 14.76–19.35 &gt;19.35</td>
</tr>
<tr>
<td>The third Training groups 2 year of training, emulative period (May-June)</td>
<td>The rates of biological maturing, points 1</td>
<td>2 3</td>
</tr>
<tr>
<td>The third Training groups 2 year of training, emulative period (May-June)</td>
<td>The index of weight and growth, g/cm &lt;290</td>
<td>290–314 315–341 342–360 &gt;360</td>
</tr>
<tr>
<td>The third Training groups 2 year of training, emulative period (May-June)</td>
<td>The abilities of speed and power (standing long jump, cm) &lt;165</td>
<td>165–185 186–218 219–239 &gt;239</td>
</tr>
<tr>
<td>The third Training groups 2 year of training, emulative period (May-June)</td>
<td>The abilities of speed and power (the increase of results in standing long jump, %) &lt;4.70</td>
<td>4.70–9.44 9.45–15.95 15.96–20.70 &gt;20.70</td>
</tr>
<tr>
<td>The third Training groups 2 year of training, emulative period (May-June)</td>
<td>SVMR, ms &gt;233</td>
<td>211–233 201–210 177–200 &lt;177</td>
</tr>
<tr>
<td>The third Training groups 2 year of training, emulative period (May-June)</td>
<td>The quantity of whorls on fingers of both hands 0–2</td>
<td>3–4 5–6 7–8 9–10</td>
</tr>
</tbody>
</table>

Note: *1 – overgrown teenager, 2 – mediant, 3 – retardant
The mark scale for the selected indicators (the index of weight and growth, the degree of the pilosity of a pubis and an axillary hollow, the quantity of curls on fingers of both hands, the time of simple visually-motor reaction, the result in 30-metre run straight off, the rates of an increase of results in 30-metre run straight off, the result in standing long jump, the rates of an increase of results in standing long jump) has been developed on the basis of the material of ascertaining pedagogic experiment, and also the curriculum “Track and field athletics (sprint) for specialized sports establishments and schools of the Olympic reserve”.

On the basis of factors of weightiness and the developed scale of points on each indicator there have been created formulas for the estimation of perspective qualities of young sprinters at the stage of initial sports specialization.

The maintenance of the integrated technique of the estimation of motor abilities of sprinters at the stage of initial sports specialization is presented in Table 3, taking into account the most informative indicators defining perspective qualities of young athletes.

### Table 3

#### The integrated technique of the estimation of motor abilities of sprinters at the stage of initial sports specialization

<table>
<thead>
<tr>
<th>Components</th>
<th>The first stage of testing</th>
<th>The second stage of testing</th>
<th>The third stage of testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st component</td>
<td>The integrated testing</td>
<td>Training groups 1 year of training, preparatory period (September)</td>
<td>Training groups 1 year of training, preparatory period (September)</td>
</tr>
<tr>
<td>The tasks</td>
<td>To estimate the initial level of physical development, the indicators of physical readiness, dermatoglyphy, the functional condition of the central nervous system (CNS), the rates of biological development</td>
<td>Identify the rate of increase of physical fitness indicators for one training cycle. Physical dynamics, features of the functional state of the CNS taking into account the rate of biological development and dermatoglyphic characteristics.</td>
<td>The same, as at the second stage of testing. Besides, the size of rates of the increase of indicators of physical readiness for two training cycles is defined</td>
</tr>
<tr>
<td>The formulas of the calculation of the estimation of perspective qualities of sprinters</td>
<td>$O_1=0.197×X_1+0.238×X_2+0.048×X_3+0.095×X_4+0.231×X_5+0.190×X_6$, where $O_1$ — the estimation of perspective qualities of sprinters at the first stage; $X_1$ — the index of weight and growth; $X_2$ — the result in 30-30 meters flying start; $X_3$ — the quantity of whorls on fingers of both hands; $X_4$ — the rates of biological maturing; $X_5$ — the result in standing long jump</td>
<td>$O_2=0.098×X_1+0.142×X_2+0.026×X_3+0.063×X_4+0.138×X_5+0.201×X_6$, where $O_2$ — the estimation of perspective qualities of sprinters at the second stage; $X_1$ — the index of weight and growth; $X_2$ — the rates of biological maturing; $X_3$ — the quantity of whorls on fingers of both hands; $X_4$ — SVMR; $X_5$ — the result in 30 meters flying start; $X_6$ — the increase of results in standing long jump (during one training cycle); $X_7$ — the result in a long jump from a place; $X_8$ — the increase of results in standing long jump (during one training cycle)</td>
<td>$O_3=0.098×X_1+0.142×X_2+0.026×X_3+0.063×X_4+0.138×X_5+0.201×X_6$, where $O_3$ — the estimation of perspective qualities of sprinters at the third stage; $X_1$ — the index of weight and growth; $X_2$ — the rates of biological maturing; $X_3$ — the quantity of whorls on fingers of both hands; $X_4$ — SVMR; $X_5$ — the result in 30 meters flying start; $X_6$ — the increase of results in 30-metre run straight off (during two training cycles); $X_7$ — the result in standing long jump; $X_8$ — the increase of results in standing long jump (during two training cycles)</td>
</tr>
</tbody>
</table>

#### The estimation of perspective qualities of sprinters (points)

<table>
<thead>
<tr>
<th>Preliminary</th>
<th>Intermediate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;3.63</td>
<td>high</td>
<td>&gt;3.13</td>
</tr>
<tr>
<td>3.29–3.63</td>
<td>above the average</td>
<td>2.64–3.13</td>
</tr>
<tr>
<td>2.82–3.28</td>
<td>average</td>
<td>1.95–2.63</td>
</tr>
<tr>
<td>2.46–2.81</td>
<td>below the average</td>
<td>1.44–1.94</td>
</tr>
<tr>
<td>&lt;2.46</td>
<td>low</td>
<td>&lt;1.44</td>
</tr>
</tbody>
</table>

#### 3rd component

| The description of the differentiation in training groups according to their estimation of perspective abilities | The revelation of potential and the forecast of motor abilities of sprinters on the basis of the estimation of perspective qualities | The forming of training groups of the 3rd year of training on the basis of the estimation of perspective qualities of athletes |

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**Note:** The formulas and entries have been transcribed to maintain the natural structure and context of the text, ensuring that the layout is consistent with the provided guidelines.
For the purpose of revealing the efficiency of the developed technique there a forming pedagogical experiment (FPE) has been carried out, in which 40 runners on short distances (boys) at the age of 12 years with the normal rate of biological maturing have taken part.

At the first stage of FPE the integrated testing on the basis of the developed technique has been held. On the basis of the received mark of the estimation of perspective qualities the engaged have conditionally been divided into two groups: experimental (the estimation of perspective qualities “above the average” and “high”) and control (the estimation of perspective qualities “average”, “below an average” and “low”).

The athletes of experimental (n = 14) and control (n = 26) groups were engaged in identical curricula “Track and field athletics (sprint) for specialized sports establishments and schools of the Olympic reserve”.

In the beginning of forming a pedagogic experiment athletes of control and experimental groups did not differ essentially (p > 0.05) in the indicators: the index of weight and growth, the results in 30-metre run straight off, the results in standing long jump, the competitive result in 60-metre run. Hence, the given groups were homogeneous and corresponded to requirements for carrying out the pedagogic experiment.

At the second stage of FPE after the repeated integrated testing between control and experimental groups there were authentic distinctions (p < 0.01) in the indicators: the index of weight and growth, the results in 30-metre run straight off, the results in standing long jump, the competitive result in 60-metre run. Athletes from experimental group had the average rates of all indicators higher (Table 4).

### Table 4

<table>
<thead>
<tr>
<th>The rates</th>
<th>The control group</th>
<th>The experimental group</th>
<th>The reliability of distinctions between groups (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The index of weight and growth, g/cm</td>
<td>288.64 ± 13.76</td>
<td>312.71 ± 11.36</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>30 meters flying start, s</td>
<td>3.77 ± 0.04</td>
<td>3.41 ± 0.06</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Standing long jump, cm</td>
<td>211.77 ± 11.70</td>
<td>236.14 ± 6.94</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>The competitive result in 60-metre run</td>
<td>7.77 ± 0.13</td>
<td>7.41 ± 0.13</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

After the end of FPE (the third stage) the indicators: the index of weight and growth, control and pedagogic tests and the competitive result in 60-metre run – have appeared better in experimental group (Table 5).

### Table 5

<table>
<thead>
<tr>
<th>The rates</th>
<th>The control group</th>
<th>The experimental group</th>
<th>The reliability of distinctions between groups (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The index of weight and growth, g/cm</td>
<td>310.76 ± 13.30</td>
<td>336.51 ± 12.14</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>30 meters flying start, s</td>
<td>3.74 ± 0.47</td>
<td>3.19 ± 0.16</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Standing long jump, cm</td>
<td>221.61 ± 10.61</td>
<td>244.14 ± 7.39</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>The competitive result in 60-metre run</td>
<td>7.59 ± 0.16</td>
<td>7.31 ± 0.14</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

By the results of the performances during the season 2018–2019 it was noticed that the majority (72.56%) of winners and prize-winners of city, regional and republican competitions were from the experimental group, which had the estimation of perspective qualities “above the average” and “high”, while sprinters with the estimation of perspective qualities “average”, “below the average” and “low” were not included into this number.
The results of the coaches’ questionnaire survey showed that forecasting the development of motor skills at the stage of initial sports specialization is not very accurate. The reasons for the low accuracy of motor ability prediction, according to coaches, are: lack of intuition, lack of anatomical and physiological, genetic knowledge, knowledge of psychology and psychophysiology. To improve the accuracy of prediction, most specialists consider it necessary to use a set of methods. At the same time, in practice many of them are not inclined to use a large number of control exercises and tests. A considerable part of coaches use a very narrow set of methods, as a rule, these are pedagogical observations, conversations, surveys, control and pedagogical tests. The survey data showed that most coaches consider the athlete’s innate inclinations as one of the important factors for achieving high results (Henriksen et al., 2010; Баранаев, 2015).

The dynamics of rates of the increase of indicators of physical readiness of young runners on short distances is characterized by the fact that at the age of 12–13 years the greatest increase of speed and power is found. Along with it the time of simple visually-motor reaction is reduced. At the age of 13–14 the indicators of high-speed abilities, speed and power abilities and high-speed endurance improve considerably, and also the high increase of the indicators of physical development is observed. The tendency to quantity increase of overgrown teenagers during the period from 12 to 14 years (from 15.79 to 67.13%) is revealed.

The analysis of correlation interrelation between the indicators of physical development, physical fitness, rate of biological maturation, psychomotor skills, dermatoglyphics allowed to establish that at the stage of initial sports specialization in athletes-sprinters there are close correlation interrelations (p < 0.01–0.05) between the indicators of physical fitness and physical development (r = 0.54–0.77). The rate of biological maturation (r = 0.46–0.78 at p < 0.01–0.05) also has a significant impact on the level of physical fitness. In addition, with an increase in the sports category decreases the value of indicators of physical development, and increases the value of indicators of psychomotor skills and dermatoglyphics, i.e., the more qualified the sprinters, the greater the role starts to play the congenital makings.

The most informative indicators, which define the level of perspective qualities of young sprinters at the stage of initial sports specialization, is the data of physical development (the index of weight and growth); physical readiness (the results in 30 meters flying start, in a standing jump and their rates of increase); rates of biological maturing (the degree of the pilosis of a pubis and an axillary hollow); psychomotility (the time of simple visually-motor reaction); dermatoglyphy (the quantity of whorls on fingers of both hands).

The developed integrated technique of the estimation of motor abilities of sprinters at the stage of initial sports specialization contains 3 components, taking into account the most informative indicators, which define the perspective abilities of young athletes. The efficiency of the developed technique consists in the qualitative selection of young athletes, capable to show high sports results in sprint.

The complex technique of predicting the motor abilities of sprinters at the stage of initial sports specialization is characterized by:

- complex analysis of different sides of the athlete by means of different methods (pedagogical, morphological, psychophysiological, dermatoglyphic);
- an optimal set of simple and informative methods, the application of which allows mass testing in practice;
- no special training of the investigator is required to conduct the testing.

The results of the forming pedagogical experiment showed high efficiency of the method we have developed. During the experiment in both groups (experimental and control) observed a positive trend in all indicators reflecting the level of physical development and physical fitness of young sprinters. This happened both due to the natural growth and development of the children’s body, and under the influence of sports training. However, statistically reliable differences (p < 0.01–0.05) were recorded between the control and experimental groups in terms of physical fitness (results in 30 meters flying start and long jump), physical development (weight and height index) and competitive performance. All the subjects were subjected to the same training effects, but the athletes of the experimental group with the evaluation of the prospects “above average” and “high”, showed a great positive dynamics in the studied indicators for the same period of time in relation to the athletes-sprinters of the control group. Thus, the final results
of the forming pedagogical experiment convincingly showed the advantage of the proposed method.

Conclusion

1. The analysis of the scientific and methodological literature and the results of the held researches have allowed to define that reliability and prediction of the effectiveness of motor abilities increases on the basis of the use of the complex of methods.

2. The conducted researches testify that indicators of physical readiness are closely connected among themselves, with the indicators of physical development, dermatoglyphy, the functional condition of the central nervous system of young athletes. The most informative indicators, which define the level of perspective qualities of young sprinters at the stage of initial sports specialization are established, namely: the data of physical development (the index of weight and growth); physical readiness (the results in 30-metre run straight off, in standing long jump and their rates of an increase); the rates of biological maturing (the degree of the pilosis of a pubis and an axillary hollow); psychomotility (the time of simple visually-motor reaction); dermatoglyphy (the quantity of whorls on fingers of both hands).

3. The developed integrated technique of the estimation of motor abilities of sprinters at the stage of initial sports specialization taking into account the most informative indicators, which define the perspective qualities of young athletes, does not demand special skills and abilities. It is simple and accessible in application, allows to receive objective indicators of investigated qualities, has simple system of estimations. During the forming pedagogic experiment in both groups (experimental and control) was observed positive dynamics in all indicators, which reflect the level of physical development and physical readiness of young sprinters as all examinees were undergone identical training influences. At the same time, the sportsmen of experimental group, who have the estimation of perspective qualities “above average” and “high”, had great positive dynamics in investigated indicators during the identical time interval in relation to the sprinters of the control group, that confirms the efficiency of the integrated technique of the estimation of motor abilities of sprinters at the stage of initial sports specialization taking into account the most informative indicators, which define the perspective qualities of young athletes.

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INTEGRUOTOJI SPRINTERIŲ FIZINIŲ GEBĖJIMŲ VERTINIMO TECHNIKA PRADINĖS SPORTINĖS SPECIALIZACIJOS ETAPE

Jurij Baranaev
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SANTRAUKA

Straipsnyje nagrinėjamos perspektyvių vaikų ir paauglių atrankos į lengvosios atletikos vaikų ir jaunimo sporto mokyklas problemos. Darbe pateikiami 12–14 metų amžiaus bėgikų sprinterių ilgalaikių tyrimų rezultatai.

Darbo tikslas – mokslinis bėgikų sprinterių motorinių gebėjimų prognozavimo pagrindimas ankstyvosios specializacijos etapu.

Tyrimo objektas – trumpųjų nuotolių bėgikų treniruočių procesas pradinės sporto specializacijos etapu.

Mokslinę šio tyrimo metodologiją sudaro tyrimo metodai, teikiantys patikimą empirinę medžiagą ir jos pirminį apdorovimą. Taikyti šie tyrimo metodai: mokslinės literatūros analizė, anketavimas, antropometiniai matavimai, psichofiziologinio testavimo metodai, biologinės brandos vertinimas, dermatoglifikos (odos piešiniai), matematinės statistikos metodai.

Buvo parengta ir aprobuota kompleksinė jaunųjų trumpųjų nuotolių bėgikų motorinių gebėjimų prognozavimo metodika. Siekiant įvertinti parengtos metodikos veiksmingumą, buvo vykdomas pedagoginis eksperimentas, kuriame dalyvavo 40 normalios biologinės brandos berniukų, trumpų nuotolių bėgikų, kurių amžius buvo 12–14 metų. Tyrimai buvo atlikti Vitebsko ir Minsko olimpinės pamainos pamainos rengimo programa. Parazymetina, kad jaunųjų sportininkų perspektyvų vaikų ir jaunimo sporto mokyklose.

Apibendrinus eksperimente dalyvavus vaikų sporto rezultatus 2018–2019 m. nustatyta, kad dauguma (72,56 %) miestų, srities ir respublikos varžybų nugalėtojų ir prizininkų sudarė jaunieji sportininkai, dalyvavę ekperimentinėje rengimo programoje, o jų parengumas buvo įvertintas kaip „aukštesnis nei vidutinis“ ir „aukštas“. Sprinteriai, kurių fizinio parengtumo perspektyvumas buvo įvertintas kaip „žemesnis nei vidutinis arba „žemas“, tarp nugalėtojų ir prizininkų nepateko. Pedagoginio eksperimento rezultatai parodė taikytos rengimo metodikos veiksmingumą. Patvirtinta, kad jaunųjų sportininkų perspektyvų vaikų ir jaunimo sporto mokyklose.