



SPSS Statistical Analysis of the Selection of Juvenile Female Sprinters in Heilongjiang Province Based on the “Body-Physiology” Model

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Abstract. Based on the “body-physiology” model, this paper conducts the SPSS statistical analysis on the indicators of juvenile female sprinters in Heilongjiang Province from the aspects of height and weight of physical quality, chest circumference, lower limb length of body shape, heart rate, lung capacity, and blood pressure of physiological function. According to correlation and regression analysis of the data, the correlation coefficients and regression equations among the above dimensions in the model and the performance of sports are derived to illustrate the main criteria for the selection of juvenile female athletes and to provide a theoretical basis and practical support for promoting the construction of athletics teams.

Keywords: Heilongjiang Province · athletics · juvenile female sprinters · selection

1 Preface

(I) Research Background

Chinese Youth Athletics Teaching and Training Syllabus (hereinafter referred to as Syllabus) is the guiding syllabus for teaching and training for China’s youth athletics. The selected evaluation indicators set by the syllabus are the important basis for the selection of reserve talents in sports schools at all levels, and they function as a guide for improving the level of reserve talents in China’s athletics. The scientific and reasonable setting of selection indicators is crucial for the evaluation of athletes’ body shape, function, and quality. The selection of sprinters is often closely related to their training years. Therefore, there is a long time span between primary selection and advanced selection, which means that from selecting talents to making achievements, the standards applied to sprinters of different levels and stages are different. At present, few studies have targeted the primary and advanced selection of juvenile sprinters in Heilongjiang Province. Therefore, this study is a comparative analysis of the selected indicators from the perspectives of body shape, physical quality, physiological function, and performance of juvenile female

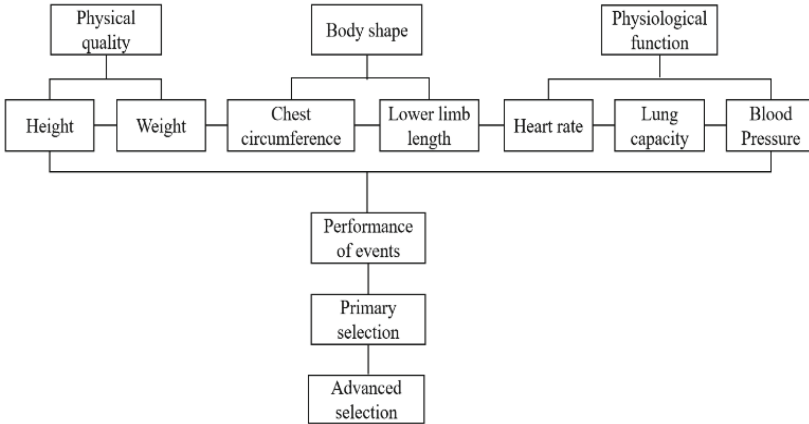


Fig. 1. Statistical analysis model

sprinters, combined with the situation of female athletes aged 12–17 years old in the age group competition of youth athletics in Heilongjiang Province. The study aims at providing a reasonable and scientific reference for the scientific selection and training for sprinting events.

(II) Theoretical framework and analytical model

Based on the law of humans’ physical and mental development, the selection model of juvenile female sprinters is developed and constructed with the data obtained from the tracking test of the age group competition of juvenile athletics in Heilongjiang Province (see Fig. 1). On the basis of a body of relevant literature and the summary of previous research work, this study analyzes the selection of juvenile female sprinters in terms of physical quality, body shape, physiological function, and performance. Based on a body of relevant literature and a summary of previous research work, this study analyzes the selection of juvenile female sprinters. Based on a large amount of relevant literature and summarizing previous research work, this study mainly analyzes the selection of juvenile female sprinters from the aspects of physical quality, body shape, physiological function, and performance. With the expectation to scientifically explore the characteristics of the selection of athletes in Heilongjiang Province and improve the accuracy of the selection, this study aims at providing a practical and theoretical basis for the selection of juvenile female sprinters in the future and contributing to the prosperity of China’s athletic career.

2 Materials and Methods

(I) Research subjects and basic information

In the selection of the research subjects, to analyze the selection of juvenile female sprinters, this paper takes female athletes aged 12–17 years old participating in sprinting events as the test objects, and their body shape, physical quality, and physiological function, and performance as the research subjects. Meanwhile, the

database was established with the original data, and the data software was analyzed and processed with SPSS18.0 to determine the selection indicators based on each ability of athletics. Since some indicators are affected by factors such as training years and age, these indicators are studied with the Delphi method and statistical calculation, and regression equation and covariance analysis were carried out on this basis. The analysis of the difference in abilities of athletes in different groups adopts the method of non-parametric test (Table 1).

(II) Research methods and variable definitions

The selection of measurement indicators is the basis and key for this study. Therefore, this study made it a key task, and theoretical demonstration and pre-experiment were conducted. During the pre-selection of indicators, coaches from Heilongjiang Normal University, Heilongjiang Institute of Sports, and Heilongjiang Provincial Sports Team were invited to determine the indicator system for the test by the Delphi method. 15 physical quality indicators were tested on the athletes who participated in the girls' sprint event in the Heilongjiang Provincial Youth Athletics Age Group Competition, (see Table 2 for specific criteria). Data were true and valid.

Table 1. Basic information about the study subjects

| | Level | Number of people | Average age | Average training years |
|-----------------|--------------------------------------|------------------|-------------|------------------------|
| Excellent group | National first-level | 15 | 17 | 6 |
| General group | Second level, below the second level | 80 | 14 | 3 |

Table 2. Experts' selection of indicators of body shape, function, and physical quality of female sprint athletes in Heilongjiang Province

| Test indicators | Indicators (11 items) | Physiological function indicators (3 items) |
|--------------------------------|---|---|
| Indicators selected by experts | height, weight, Quetelet index, sitting height, shin-length, Achilles tendon length, thigh length, lower limb B, chest circumference, finger space, finger space minus height | blood pressure, lung capacity, heart rate |

3 Results and Discussion

(I) Findings

1. Results and analysis of a survey on the body shape of juvenile female sprinters

Body shape plays an important element in the selection of sprinters. Height and weight are the index reflecting the level of sprinters' physical development which provide great advantages for accelerating, running on the way and sprinting.¹ The data of juvenile sprinters in the age group competition of juvenile athletics in Heilongjiang Province were analyzed. SPSS18.0 was used to show the trend of the data. Standard deviation was used to measure the degree of dispersion, and covariance analysis was used to reflect the significance of the differences between and within groups to further reveal the characteristics of the overall body shape of the juvenile female sprinters in Heilongjiang Province. From Table 3, it is shown that the range of the average height of female sprinters in Heilongjiang Province was 26 cm, the average height was 166.27 cm, and the mean of finger space minus height was 1.31 cm.

(1) Results and analysis of the survey on the height and weight of juvenile female sprinters

1) Height:

As an important indicator of sprinters' body shape, height is an indicator reflecting the level of physical growth of athletes, which is influenced by genetic factors. From Table 4, it is shown that the height of juvenile female sprinters grows faster from 12 to 13 years old, and still increases year by year from 14 to 16 years old

Table 3. Statistical analysis of body shape of female sprinters in Heilongjiang Province

| Gender | Mean | Standard deviation | Variance | Max | Min | Med | Range |
|---------------------------|--------|--------------------|----------|-------|------|--------|-------|
| Height | 166.27 | 5.764 | 33.219 | 181 | 158 | 169.50 | 26 |
| Weight | 60.827 | 11.5406 | 133.186 | 101.0 | 46.1 | 77.750 | 54.9 |
| Quetelet index | 365.83 | 63.984 | 4093.889 | 569 | 291 | 455.50 | 278 |
| Sitting height | 91.85 | 2.919 | 8.520 | 97 | 86 | 92.00 | 11 |
| Thigh-length | 71.58 | 22.908 | 524.772 | 99 | 28 | 84.50 | 71 |
| Shin-length | 46.71 | 2.398 | 5.750 | 52 | 40 | 47.00 | 12 |
| Achilles Tendon length | 19.48 | 2.223 | 4.942 | 24 | 15 | 20.00 | 9 |
| Lower limb B | 85.55 | 6.939 | 48.153 | 106 | 71 | 85.00 | 35 |
| Chest circumference | 96.29 | 8.239 | 67.882 | 114 | 76 | 96.00 | 38 |
| Finger space | 170.66 | 7.483 | 55.998 | 184 | 155 | 170.00 | 29 |
| Finger space minus height | 1.31 | 5.980 | 35.757 | 18 | -15 | 1.00 | 33 |

Table 4. The analysis of the height of female sprinters aged 12–17 years old in age group competition of youth athletics in Heilongjiang Province

| Age | N | Max | Min | Harmonic mean | Mean | Standard deviation |
|-----|----|--------|--------|---------------|---------|--------------------|
| 12 | 30 | 162.30 | 148.00 | 158.385 | 158.697 | 6.4922 |
| 13 | 45 | 170.40 | 144.00 | 163.216 | 163.527 | 7.1916 |
| 14 | 89 | 177.50 | 148.30 | 163.538 | 163.755 | 6.6181 |
| 15 | 90 | 178.30 | 153.00 | 164.162 | 164.378 | 5.5062 |
| 16 | 70 | 180.80 | 156.50 | 165.944 | 166.002 | 5.1247 |
| 17 | 50 | 178.00 | 165.70 | 168.345 | 165.511 | 6.5766 |

year by year, but the growth rate becomes slower. At 17 years old, the growth rate of height decreases slightly. This phenomenon is the result of the early growth and development of girls.

2) Weight.

As important as height in women's sprinting, weight is the bodyweight that generally reflects the athletes' nutritional status, strength, physical quality, and explosive strength. The mean weight values of women in Table 5 show an increasing trend year by year. The weight of 12–16 years old increases year by year, while the weight of 17-year-old female athletes decreases and the weight indicator increases, and the trend is quite obvious. At the same time, the data also show that there is a huge variation in the weight of athletes, the dispersion of weight, and the standard deviation of height in each age group. Although the body shape of female athletes is relatively standard, the majority have uneven body shapes and weight. Therefore, the control of athletes' daily diet should be strengthened. The training work of athletes' anaerobic endurance, explosive strength, speed, and flexibility should be the focus in the training of sprint events so that their weight reaches a good standard athletes' future training and competition results can soar.

3) Quetelet index (weight/height \times 1000).

The Quetelet index reflects the proportional relationship between weight and height, indicating the weight per centimeter of height as a relative weight to reflect the width, thickness, circumference, and body tissue density of the human body which is an important composite index to evaluate the level of human morphological development and evenness. 2 Based on the principle of mechanics, $f = ma$, the athlete should not be too heavy, otherwise, too much weight will lead to a reduction in frequency. During running, the heavier the weight, the faster the acceleration, and the faster its running frequency. At the same frequency, height and stride determine the speed. In other words, the smaller the Cortolay index, the better athletes grow. Therefore, the selection standard of juvenile female sprinters should be fine bone

Table 5. The analysis of the weight of female sprinters aged 12–17 years old in age group competition of youth athletics in Heilongjiang Province

| Age | N | Max | Min | Harmonic mean | Standard deviation |
|-----|----|-------|-------|---------------|--------------------|
| 12 | 30 | 57.60 | 30.50 | 43.367 | 7.4152 |
| 13 | 45 | 70.50 | 30.00 | 51.552 | 12.2219 |
| 14 | 89 | 86.90 | 33.00 | 52.954 | 9.4913 |
| 15 | 90 | 86.10 | 35.80 | 53.354 | 10.2780 |
| 16 | 70 | 91.00 | 40.00 | 55.750 | 12.4314 |
| 17 | 50 | 65.90 | 45.30 | 55.759 | 5.5526 |

diameter and appropriate weight, so that excellent results can be better achieved (Tables 6, 7 and 8).

(2) Results and analysis of a survey on the length and circumference of body parts of juvenile female sprinters

1) Chest circumference

Chest circumference, the maximum circumference of the human chest, indicates the development of chest muscles and the size of the chest, effectively reflecting the development of body shape and respiratory organs. From the analysis of the data, it is shown that the development of the chest circumference of juvenile female sprinters is proportional to height and weight, and the standard deviation of the chest circumference is decreasing year by year. The individual athletic ability of the athletes is mainly manifested by the physical quality and the proportionality of limb circumference. Tall female sprinters who have a large bust circumference, narrow waist, thin pelvis, short trunk, and long lower limbs tend to have the ability to withstand high levels of training.

Table 6. Quetelet index statistics of female sprinters aged 12–17 years old in age group competition of youth athletics in Heilongjiang Province

| Age | Mean | Standard deviation | Variance | Max | Min | Med |
|-------|--------|--------------------|----------|-----|-----|--------|
| 12 | 522.50 | 50.121 | 2140.500 | 534 | 531 | 532.50 |
| 13 | 443.80 | 53.954 | 2872.700 | 539 | 291 | 498.00 |
| 14 | 413.55 | 50.752 | 2575.784 | 514 | 305 | 439.00 |
| 15 | 448.57 | 53.476 | 2859.648 | 534 | 336 | 460.00 |
| 16 | 454.00 | 63.487 | 4030.571 | 559 | 370 | 466.00 |
| 17 | 510.25 | 52.886 | 2796.917 | 569 | 449 | 531.50 |
| Total | 453.44 | 63.984 | 4093.889 | 569 | 291 | 455.50 |

Table 7. The analysis of chest circumference of female sprinters aged 12–17 years old in age group competition of youth athletics in Heilongjiang Province

| Age | N | Maximum | Minimum | Harmonic mean | Standard deviation |
|-----|----|---------|---------|---------------|--------------------|
| 12 | 30 | 86.80 | 65.30 | 73.048 | 8.6407 |
| 13 | 45 | 106.40 | 62.40 | 79.524 | 8.4170 |
| 14 | 89 | 108.20 | 65.50 | 82.596 | 6.8052 |
| 15 | 90 | 110.30 | 69.20 | 82.327 | 6.6630 |
| 16 | 70 | 105.00 | 73.70 | 103.649 | 6.6514 |
| 17 | 50 | 92.040 | 77.20 | 85.968 | 3.1800 |

2) Lower limb length

Lower limb length includes thigh length, lower limb B, shin length, and Achilles tendon length. The sprinters' running speed depends on the length of the lower limbs, which is an indicator reflecting the growth and development of the skeleton and also an important indicator to predict the future performance of juvenile female sprinters. Juvenile female sprinters grow and develop earlier, and the development of lower limbs is earlier than that of upper limbs. The analysis of the mean and standard deviation of the data shows that the mean Achilles tendon length of juvenile female sprinters aged 12–17 years shows an increasing trend year by year, but the growth trend slows down at the age of 16 and 17 years old. The development of sprinters' Achilles tendon is a decisive factor in their explosive strength and sprinting performance. The thigh muscles of sprinters are relatively developed and have strong explosive force. It means that sprinters with smaller ankle circumference, longer Achilles tendon and greater leg muscle strength whose speed strength will be better. Furthermore, during training and competition, the Achilles tendon of sprinters has been found to be long and slender.³ Therefore, in the selection of juvenile female sprinters who are in the early and middle puberty, it's important to consider that the indicators of lower limb length should be large. In the selection of talents, the Achilles tendon length, lower limb length B, and shin-length should be the selected indicators of the lower limb in order to reflect the competitive rules and characteristics of sprinting.

2. Results and analysis of a survey on physiological functions of juvenile female sprinters

Sprint is a sport requiring excellent cardiac output and respiratory function.⁴ The physiological functions of athletes are required to show normal blood pressure, slow respiratory rate, high hemoglobin content, high lung capacity, low pulse rate per minute, and long breath holding time. This study mainly targets the heart rate, blood pressure, and lung capacity of female juvenile athletes, reflecting the degree of dispersion by using standard deviation, the significance of intergroup and intragroup differences by using variance analysis, and the concentration trend of data by using

Table 8. The analysis of Lower limb length of female sprinters aged 12–17 years old in age group competition of youth athletics in Heilongjiang Province

| Age | Content | Lower limb B length | Thigh-length | Achilles tendon length | Shin-length |
|-----|--------------------|---------------------|--------------|------------------------|-------------|
| 12 | Mean | 80.5882 | 79.4412 | 19.1471 | 33.0750 |
| | Standard deviation | 6.37435 | 10.9371 | 2.19206 | 4.01036 |
| 13 | Mean | 81.2813 | 80.4844 | 19.6875 | 35.1857 |
| | Standard deviation | 3.68943 | 4.51607 | 1.80836 | 5.90389 |
| 14 | Mean | 84.9356 | 83.1655 | 19.8210 | 38.4443 |
| | Standard deviation | 5.46334 | 6.96621 | 2.23230 | 5.02749 |
| 15 | Mean | 83.7818 | 82.8011 | 19.9154 | 42.7311 |
| | Standard deviation | 4.74168 | 7.55203 | 2.32564 | 5.74173 |
| 16 | Mean | 84.1020 | 83.1531 | 20.4388 | 45.6429 |
| | Standard deviation | 4.77840 | 4.29656 | 2.29726 | 2.21970 |
| 17 | Mean | 85.4844 | 84.3844 | 20.5937 | 43.1632 |
| | Standard deviation | 5.93715 | 5.15990 | 2.48686 | 4.30251 |

the mean. This study analyzes the physiological characteristics of juvenile female sprinters in Heilongjiang Province.

(1) Results and analysis of a survey on the heart rate of juvenile female sprinters.

Heart rate refers to the times the heart beats in one minute. The method of testing heart rate is a direct and simple pulse test, and the pulse and heart rate are the same under quiet conditions. Since athletes mainly adapt to sprinting by increasing their heart rate to strengthen their cardiac output in training, their cardiovascular function is generally evaluated by measuring the cardiac performance index of juvenile female athletes and their development levels are inferred by the level of myocardial development. It can be seen from Table 9 that the heart rate changes of athletes will show a downward trend as they age, which is manifested by the fact that as athletes age, the number of pulses immediately after exercise is less; the number of pulses during the recovery period is less; the faster the heart function recovers; the contraction force of the cardiac muscle is larger and pumping function of the heart is stronger. It is reflected that the heart functions of athletes are preserved after completing large load training.

(2) Results and analysis of a survey on lung capacity of juvenile female sprinters

Lung capacity refers to the amount of gas exhaled to the maximum capacity after a maximum inhalation in an unlimited time, which represents the maximum function of the lung at one time. It is a critical functional indicator to evaluate the growth and development level of the body, and it reflects the volume and the expansion capacity of the lung. Therefore, lung capacity is a reliable, stable, and effective auxiliary indicator in sports talents' selection. From Table 10, it can be concluded

Table 9. The analysis of heart rate of female sprinters aged 12–17 years old in age group competition of youth athletics in Heilongjiang Province

| Age | N | Mean | Min | Max | Standard deviation |
|-----|----|---------|-------|--------|--------------------|
| 12 | 30 | 89.0400 | 66.30 | 144.50 | 17.84904 |
| 13 | 45 | 89.1958 | 56.10 | 120.20 | 16.63917 |
| 14 | 89 | 84.7741 | 60.20 | 120.70 | 10.75044 |
| 15 | 90 | 83.8020 | 65.20 | 110.90 | 10.44891 |
| 16 | 70 | 83.7121 | 60.10 | 119.40 | 11.10849 |
| 17 | 50 | 85.7335 | 72.10 | 118.60 | 9.57056 |

that from changes in maximum, minimum, mean, and the standard deviation of the lung capacity of the female sprinters aged 12–17 years old in Heilongjiang Province, there is a growing trend for the mean and standard deviation.

(3) Results and analysis of a survey on blood pressure survey and analysis in juvenile female sprinters

Blood pressure is the lateral pressure exerted on the unit area of the vessel wall by blood in a blood vessel, which is pressure. According to the characteristics of sprinting load, the change in blood pressure reflects the situation of the cardiovascular function of sprinters and whether they are suitable for sprinting events. Since diastolic blood pressure mainly reflects the elasticity of arterial vessels and the resistance of small peripheral vessels, systolic blood pressure mainly reflects the output per beat and myocardial contraction. Generally speaking, the diastolic blood pressure remains unchanged with great intensity and load sports, while the systolic blood pressure increases with the intensity of exercise, which can be up to 200 mmHg or even higher. Therefore, it is ideal that after exercise, systolic blood pressure increases while diastolic blood pressure decreases or remains unchanged (Table 11).

Table 10. The analysis of lung capacity of female sprinters aged 12–17 years old in age group competition of youth athletics in Heilongjiang Province

| Age | N | Mean | Min | Max | Standard deviation |
|-----|----|---------|------|------|--------------------|
| 12 | 30 | 2875.00 | 1890 | 2935 | 584.853 |
| 13 | 45 | 2942.00 | 1998 | 3120 | 608.593 |
| 14 | 89 | 2668.00 | 2005 | 3310 | 608.213 |
| 15 | 90 | 3000.00 | 2000 | 3800 | 610.1206 |
| 16 | 70 | 3010.00 | 2084 | 3908 | 610.8349 |
| 17 | 50 | 3600.00 | 2100 | 4120 | 611.3209 |

Table 11. The analysis of blood pressure of female sprinters aged 12–17 years old in age group competition of youth athletics in Heilongjiang

| Age | Systolic blood pressure | | | | | Diastolic blood pressure | | | | |
|-----|-------------------------|-------|--------|----------|--------------------|--------------------------|-------|-------|---------|--------------------|
| | N | min | max | mean | standard deviation | N | min | max | mean | standard deviation |
| 12 | 30 | 78.00 | 110.00 | 95.3529 | 10.06815 | 17 | 40.00 | 68.00 | 54.0588 | 7.71744 |
| 13 | 45 | 76.00 | 126.00 | 101.0313 | 10.20273 | 32 | 46.00 | 86.00 | 61.5000 | 9.10866 |
| 14 | 89 | 80.00 | 166.00 | 102.1111 | 13.17574 | 81 | 44.00 | 83.00 | 59.6667 | 9.14604 |
| 15 | 90 | 72.00 | 140.00 | 101.9487 | 11.14707 | 78 | 48.00 | 84.00 | 59.7436 | 8.31746 |
| 16 | 70 | 80.00 | 135.00 | 100.2500 | 11.58961 | 48 | 45.00 | 80.00 | 58.4792 | 8.34875 |
| 17 | 50 | 80.00 | 120.00 | 101.3750 | 9.89216 | 32 | 44.00 | 72.00 | 59.3438 | 7.49886 |

3. Findings and analysis of a survey on the performance of juvenile female sprinters

This study adopts the statistical analysis methods of Pearson correlation, stepwise regression, and dominance analysis to reveal the differences between the scores of juvenile female sprinters in Heilongjiang Province and the scores of national athletes at the same stage respectively. The results of the analysis show that the athletic performance of the juvenile female sprinters in Heilongjiang Province is proportionate to the rating: the better the performance, the higher the rating. Meanwhile, the statistics of the paired sample T-test show that the confidence region of the curvilinearity analysis is at 95%, the t-value of the performance is 13.488, and the value of the degree of freedom df is 78. The probability of significance of the T-test Sig = 0.208 > 0.05. According to the rules of the test of significance judgment, it shows that the achievement is directly related to body shape, physical quality, and physical function.

According to Table 12, the regression equation of each indicator suitable for the performance of female sprinters in Heilongjiang Province can be is as follows: $Y = 3.871x_1 - 0.039x_2 - 0.015x_3 + 0.202x_4 - 0.613x_5 + 0.379x_6 - 0.125x_7 - 0.129x_8 + 0.035x_9 + 3.295x_{10} - 76.750$, where the score is Y, height is x_1 , weight is x_2 , Quetelet index is x_3 , sitting height is x_4 , shin length is x_5 , Achilles length is x_6 , thigh length is x_7 , lower limb B is x_8 , chest circumference is x_9 , finger space minus height is x_{10} , and constant is (-76.750). It is shown that there is a relatively strong correlation between performance and indicators such as height, weight, sitting height, Quetelet index, shin length, lower limb B, and sports performance, while there is a weak correlation between performance and indicators and qualities such as Achilles tendon length thigh length and shin length.

(II) Discussion and analysis

1. Analysis of the selection of juvenile female sprinters

The scientific selection of sprinters requires an effective long-term mechanism. The selection should start from the youth. Reasonable selection methods and advanced selection equipment are very important to scientific selection, which also requires the local government and relevant departments to attach

Table 12. Linear regression analysis of the performance of female sprinters aged 12–17 years old in age group competition of youth athletics in Heilongjiang Province

| Model | | Unstandardized coefficient B standard error | | Standard coefficient trial version | t | Sig. |
|----------|---------------------------|--|--------|---------------------------------------|--------|------|
| category | (Constant) | -76.750 | 74.549 | | -1.164 | .247 |
| | Height | 3.871 | 1.246 | 3.351 | 3.182 | .002 |
| | Weight | -.039 | .9040 | -.063 | -.041 | .967 |
| | Quetelet index | .015 | .140 | .119 | .086 | .932 |
| | Sitting height | .202 | .240 | .079 | .717 | .474 |
| | Shin length | -.613 | .248 | -.206 | -2.120 | .036 |
| | Achilles tendon length | .379 | -.343 | .104 | 1.203 | .231 |
| | Thigh length | -.125 | -.047 | -.303 | -3.391 | .001 |
| | Lower limb B | -.129 | -.148 | -.089 | -.998 | .320 |
| | Chest circumference | .035 | .046 | .052 | .657 | .512 |
| | Finger space minus height | 3.295 | 1.085 | 2.012 | 3.031 | .003 |

importance to the selection of athletes and increase the financial investment and research efforts.

(1) Primary selection of juvenile female sprinters

At present, the primary selection of sprinters in Heilongjiang Province is mainly from county high schools, traditional sports schools, county sports committees, and township primary and secondary schools. Through visits, it is collected that the main selection method of sprinters in Heilongjiang Province mainly consists of athletic performance (26.67%), syllabus (16.67%), genetic factors (16.67%), and coaches' experience (40%). Chinese Youth Athletics Teaching and Training Syllabus (hereinafter referred to as Syllabus) was rarely taken as the fundamental guideline. This shows that there is a big problem in the primary selection work, which generally simply applies the intermediate selection mode and experience. This situation reflects that Heilongjiang Province must strengthen the study and training of sprinters' selection work and enhance the scientific and cultural level of coaches and theoretical level to improve the selection channels and establish a scientific approach to athletes selection. It is of great significance to guide the scientific selection work in the future.

(2) Advanced selection of juvenile female sprinters

Genetic selection is based on the specificity, heredity, and the correlation of the traits that make up the humans' athletic ability and the characteristics of the stages they exhibit during the growth and development of the individual. Most of the human physiological structure is determined by heredity, and the data also

proved that the sprinters' congenital conditions are the main factors determining the future performance. ⁵ Therefore, genetics should be considered in primary selection, such as the physical quality, the body shape of juvenile female sprinters' parents. Besides, their performance in sprinting sports should also be fully considered which is necessary for juvenile female sprinters to improve their the performance and success rate in sprinting events.

2. Suggestions

1. The indicator of physiological function selection should mainly focus on lung capacity, heart rate, and blood pressure. Relevant personnel of selection should fully consider and improve the physiological selection rules and related equipment.
2. The selection based on body shape, physical quality and functional characteristics is not comprehensive enough. It lacks in-depth research on the rules of helping juvenile sprinters to make achievements and needs to be further improved to establish the selection indicators for juvenile female sprinters to meet the needs of Heilongjiang Province.
3. The professional level and training theory of grassroots coaches should be strengthened. The method of selecting and developing talents should be reformed and innovated. The selection structure and methods of selecting the juvenile female sprinters in Heilongjiang Province should be optimized. The scientific training level should be improved. Individualism should be reduced. Sending the excellent top runners to the Heilongjiang Province and the country should be strengthened.

4 Conclusion

1. There are significant differences in height, weight, Quetelet indicator, sitting height, shin-length, Achilles tendon length, thigh length, lower limb B, chest circumference, and finger space in juvenile female sprinters in Heilongjiang Province. The indicators are higher than the national selection standard.
2. The height of the juvenile female sprinters in Heilongjiang Province grew fast at the age of 12–13 years old. Their body shape and physical fitness indicators are close to the national selection indicators, and their physiological indicators are almost the same. At the age of 14–15 years old, their body shape indicators are higher than the national selection indicators. At the age of 16–17 years old, their body shape and physiological function are higher than the national selection indicators.
3. At the age of 12–15 years old, the athletic performance of juvenile female sprinters in Heilongjiang Province is significantly higher than the national indicators. At the age of 16–17 years old, the improvement of performance tends to level off, but still shows an upward trend, and the performance of outstanding athletes is higher than the national average.
4. In terms of physiological function, the heart rate of juvenile female sprinters in Heilongjiang Province decreases year by year at the age of 12–17 years old, blood pressure increases with the increase of sports load and intensity, and lung capacity also increases and is significantly higher than the national selection standard of lung capacity.

5. The scientific selection of juvenile female sprinters needs to be carried out persistently, and the selection should start from the youth with genetics as one of the selection priorities. The financial investment of the selection should be increased. The scientific research of the selection should be strengthened. The methods and means of selection should be innovated. The aim is to improve the limits of human body speed. Therefore, the scientific means and scientific research of related equipment for the selection of sprinters are particularly significant.

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