

# Monitoring physical development of students in a physical education university of the Russian North

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**Abstract.** Indicators of physical development in students studying in a physical education university are analyzed. It is shown that the weight-growth indicators correspond to the regional standards developed for the population of the Far North. Evaluation of morphofunctional characteristics indicate a weak development of physical qualities among the 18-20-year-old students.

**Keywords:** physical development, students, vital capacity, body length, body weight, health

## 1. Introduction

The level of physical human development depends on many factors, which include the geographical, socio-economic, psychological, traditions of education, etc., and it reflects the adaptation to the conditions of the environment. Students united by an organized learning process and lifestyle constitute a special social group. Therefore, we can assert that their physical development is a sign reflecting certain regional characteristics of the physical health of the youth population. In addition, a quantitative assessment of the physical condition provides valuable information about physical health and functional capabilities of the body, which allows adjusting the volume of organized physical activity and planning certain physical activities in the educational process in a physical education institution. The Churapcha State Institute of Physical Education and Sports is a unique educational institution; it is the first and only institution of higher education that operates in rural areas in extreme climatic conditions of the north. It was created on the basis of the famous “Korkina school” in the village of Churapcha of the Republic of Sakha (Yakutia). In total, 337 students study full-time at the institute, there are also 386 part-time students.

Currently, there is evidence that the level of physical health and physical fitness of students is very low [1, 2]. According to research specialists [3, 4, 5], the following features are characteristic of students’ health: an increase in somatic diseases, deviations in mental health, a decrease in physical development indicators. Students’ activities in the process of learning and training at a university of physical culture and sports are associated with increased physical activity. The impact of harsh climatic conditions has an important impact on the body of athletes. Severe climatic conditions are characterized by abrupt changes in weather factors (temperature drops, atmospheric pressure, humidity, etc.). These factors lead to neuro-emotional stress, disadaptation of the homeostatic systems, and poor health.

Taking into account the above-mentioned reasons, the Department of Natural Sciences of the Institute annually monitors the physical development and functional state of the body of students in all areas of training. The purpose of the study is to identify certain features in the physical development of students engaged in physical culture and sports in rural areas.

## 2. Materials and Methods

In our study, anthropometric, physiological methods and the method of standards and indexes were used. The height of subjects was recorded using a Seca electronic height meter, and the body weight was measured using floor scales. Chest circumference (CC) was measured using a measuring tape. The vital capacity of the lungs (VC) was determined using a MikroLab spirometer. Wrist dynamometry (hand strength, kg) was determined using a Collen dynamometer [6].

Studies were conducted on the basis of the Churapcha State Institute of Physical Education and Sports of the Republic of Sakha (Yakutia). 57 male students of the Yakut nationality from the first to the third year of study took part in the study. The age of students was 18-20 years.

Statistical analysis of group values was performed by Student's t-test.

## 3. Results

The results of the study are presented in Table 1. Assessment of students' physical development indicators was carried out according to standards adapted for the Republic of Sakha (Yakutia). Regional standards of human health in the North were developed in 2001 by the Institute of Health of the Yakutsk Scientific Center of the Siberian Branch of the Russian Academy of Medical Sciences [7].

**Table 1.** Indicators of physical development of students.

Indicators	Groups		
	18 years old (n=21)	19 years old (n=19)	20 years old (n=17)
Body weight, kg	65.9±6.5*	64.9±7.5	69.5±6.6*
Body length, cm	172.3±5.5	169.1±4.0*	175.2±5.8*
Vital capacity, l	3.3±0.8*	3.6±0.7	3.7±0.4*
Chest circumference (rest), cm	90.7±5.7	89.6±5.8	91.9±5.3
Wrist dynamometry (right), kg	42.6±5.8	40.7±3.9*	45.2±6.1*
Wrist dynamometry (left), kg	42.3±6.2	39.3±5.9	41.4±6.6

\* Significant differences of  $p < 0.05$  compared with the rates between groups

Assessing average group values of physical development indicates the ambiguity of received results:

1. An average body weight was  $65.9 \pm 6.5$  kg,  $64.9 \pm 7.5$  kg,  $69.5 \pm 6.6$  kg among the 18, 19, and 20-years-old students, respectively; an average length of bodies was  $172.3 \pm 5.5$  cm,  $169.1 \pm 4.0$  cm,  $175.2 \pm 5.8$  cm; an average chest circumference was  $90.7 \pm 5.7$  cm,  $89.6 \pm 5.8$  cm,  $91.9 \pm 5.3$  cm among the 18, 19, and 20-years-old students, respectively.
2. An average vital capacity of the lungs was  $3.3 \pm 0.8$  l,  $3.6 \pm 0.7$  l,  $3.7 \pm 0.4$  l among the students of 18, 19, 20 years old, respectively.
3. Wrist dynamometry for all students was in the range of 39-42 kg.

In addition to determining average group indicators of students' physical development, an individual assessment of the studied parameters of physical development was carried out (Fig. 1, Fig. 2).

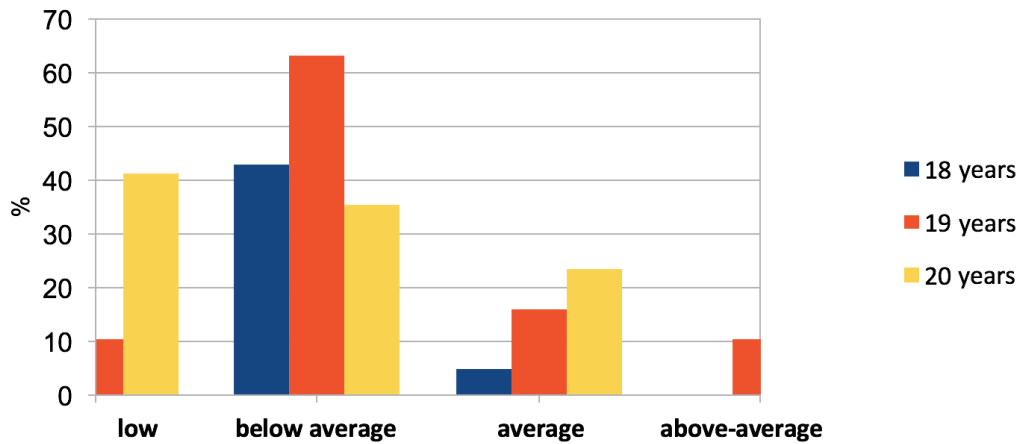


Figure 1. Individual assessment of students' body mass, %.

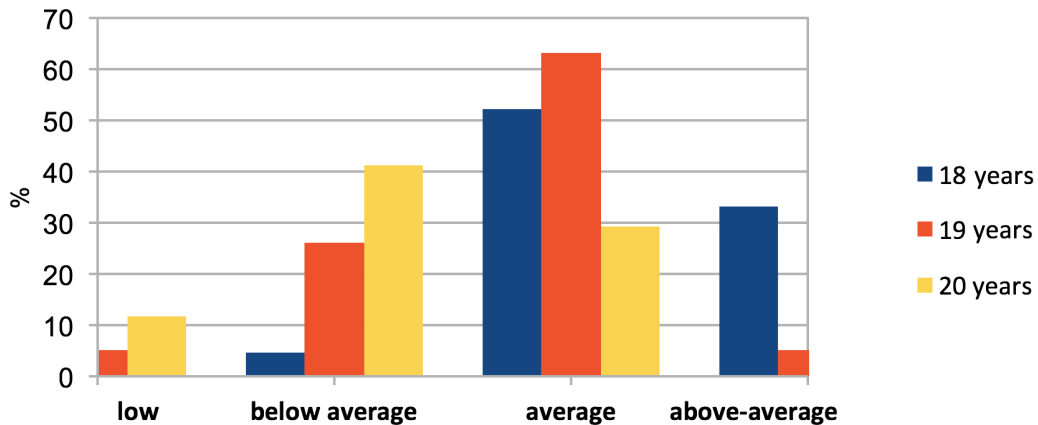


Figure 2. Individual assessment of student's body length, %.

#### 4. Discussion

Among all indicators of physical development, body length is one of the main indicators. According to results of our study, an increase in terms of body length is observed among students. The average values of body length in all three groups correspond to the average statistical body length of Yakut men [7]. We compared the data on students with the Regional Standard of the Main Physiological Indicators of the Population of the Republic of Sakha (Yakutia), which was developed in 2001. According to individual indicators, an average level of body length prevails in all three groups. The students of 19 and 20 years have medium and below average levels of body length, and only 17.6% of third-year students (20 years) have a level of body length above average (Figure 2). In 18-year-old students, growth is generally higher than in older groups: 50% have an average level of growth and 32% have a higher average.

Body weight is directly dependent on body length and indirectly reflects development of the musculoskeletal system, the subcutaneous fat layer, being one of the indicators of the impact of environmental and social factors on the human body. With respect to body weight, we found a gradual increase in parameters with increasing age. We did not observe low levels of individual body weight indicators for students of all courses. Only 10.5% of students at the age of 19 have a below average level. 20-years-old students have a higher percentage of respondents with a high level of body weight (23.5%). Most young men showed an average level of body weight. Chest circumference in combination

with indicators of length and body weight characterize the so-called “total body size.” This indicator characterizes the body volume, development of the pectoral and spinal muscles, as well as the functional state of the organs of the chest cavity. Among the studied groups, more than half of the first and second groups and almost half of the third group of respondents have a chest circumference value at a low level, and the rest is at a level “below average.” The lungs vital capacity (VC), characterizing the function of external respiration, is also one of the indicators of physical development. In our study, low CV values were found in all three studied groups of students. According to the research of many scientists, the northerners have low VC indicators [2, 3]. This is also confirmed by the results of our research: VC is lower than standard values for students in all three groups [6]. Strength of the flexor muscles of the hand increases in parallel with the increasing total muscle mass. Dynamometry of the strongest arm in men should average 65-80% of body weight [6]. Given that the average body weight of students was on 65.9-69.5 kg, they should have dynamometry at the level of 42-46 kg. In absolute terms, the average group values correspond to the standard indicators, but it should be noted that the relative strength data are lower than all standard indicators. Thus, 47% of students correspond to the norm in the 18-years-old group; 26.3% correspond to the norm in the group those who are 19 years old; and 41.2% correspond to the norm in the 20-years-old group.

## 5. Conclusion

Our comparative analysis of the results obtained shows that the students’ physical development as a whole in all indicators is at the “average” and “below average” level. The level “above average” is observed only in terms of body length in 30% of the 18-years-old students and in 17% of 20-years-old students. The body weight of almost all the students is at an average level and tends to increase with age. An average height corresponds to the average growth of Yakut men. Chest circumference at rest shows low values for most students, probably due to poor development of the pectoral and spinal muscles. Vital capacity of the lungs in all studied students corresponds to the rate of untrained men. Wrist dynamometry is normal for less than half of the students under study, the rest have low rates.

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