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Assessment of schoolchildren functional shifts in a polluted air

Environmental pollution has an adverse effect on the functional state of the body of the child population. Exposure to environmental factors leads to the development of negative effects in the health status of the population, which translates into an increase in the incidence and deterioration of physical development. The unfavorable environment adversely affects the level of physical development and functional state in children, causing a high level of functional tension. The process of adaptation of schoolchildren living in different ecological zones of well-being, accompanied by a decrease in performance. Functional stress in children living in contaminated areas in line with the levels of pronounced stress and overexertion. The incidence of schoolchildren living in areas contaminated area reflected the reduced level of resistance of the body and testified about the negative impact neblagorpiyatnyh factors on the adaptive activity of the organism adolescents.

Key words: assessment, influence, environment, weight, growth, health, harmony, pollution, factors.

The schoolchildren health monitoring is the basis for preventive and promotive activities in school. Features of the health status of different age groups pupils, the deviation from the norm most frequently detected by their, factors affecting their formation, methods of prevention should be good to know for clear and proper organization of the work.

The nature of deviations in the physical condition of modern schoolchildren depends on many factors. Radical changes in population lifestyle, caused by scientific and technological progress have not only positive but also negative aspects. Specificity of life rhythm in big cities, the rapid growth of the information flow, low physical activity, large total academic load, the violation of the day regime, mainly the action of negative environmental factors contribute to formation the number of deviations [1].

Therefore, a deeper study of the health status of teenagers living in different areas of ecological trouble, in the period of study at the secondary school has a special interest.

Materials and methods

The object of the study were schoolchildren of secondary schools in Karaganda. Two groups were identified. The main group of children living in the Oktyabrsky district, where is the industrial enterprises complex. The region arbitrarily identified as «dirty» area. The control group of children living in areas of the South-East, where there is no industry. This region was conditionally identified as «clean» area [2]. In addition the children were divided by age: 7–9 years, 10–13 years and 14 years or more, as well as by gender — boys and girls. Percentile method was used to identify the harmony of physical development in children [3].

Express method of assessing the physical condition level of a person carry on the physical condition index [4].

Methodical approach «copy pair» was used because in addition to environmental factors (area of residence), state of physiological parameters depends on the social, economic, biorhythmological and other factors. For each unit of observation in the experimental group were selected similar observation unit in the control (by age, gender, social and living indicators). Thus the area of residence was the only distinctive features for two compared groups.

Measurement of children physical development was carried out using a standard set of common methods [3].

The dynamics of the student organism functional state and the degree of regulatory systems tension during training was assessed by changes in the parameters of the cardiovascular, central and autonomic nervous systems as a sensitive indicator of adaptation using generally accepted techniques. Statistical analysis of the psycho-physiological parameters was performed using standard statistical software package. Sociological research methods were processed by conventional methods to the definition of expectation value, mean square deviation, error of mean and reliability of the differences (by Student's).

Results and Discussion

Children population health is formed under influence a complex set of biological, ecological and social factors. Physical development of children and adolescents, which characterizes the process of growth and maturation of the growing organism, is a leading criterion of population health. It allows to predict the viability of the country's adult population [5].

General dynamics of anthropological indicators were relevant to the age peculiarities. However, credible differences between growth and weights pupils according to their age limits, depending on the environmental conditions at the residence place were found. Moreover, this trend was not in favor of children living in the environmental stress area.

By centile assessment of schoolchildren physical development of studied groups (Fig. 1) more expressed differences were noted among boys of the second age group (10–13 years), and the girls in the first age group (7–9 years).

Integral values that characterize index of the physical state may be a further confirmation of the negative impact of unfavorable ecological situation in the students physical development.

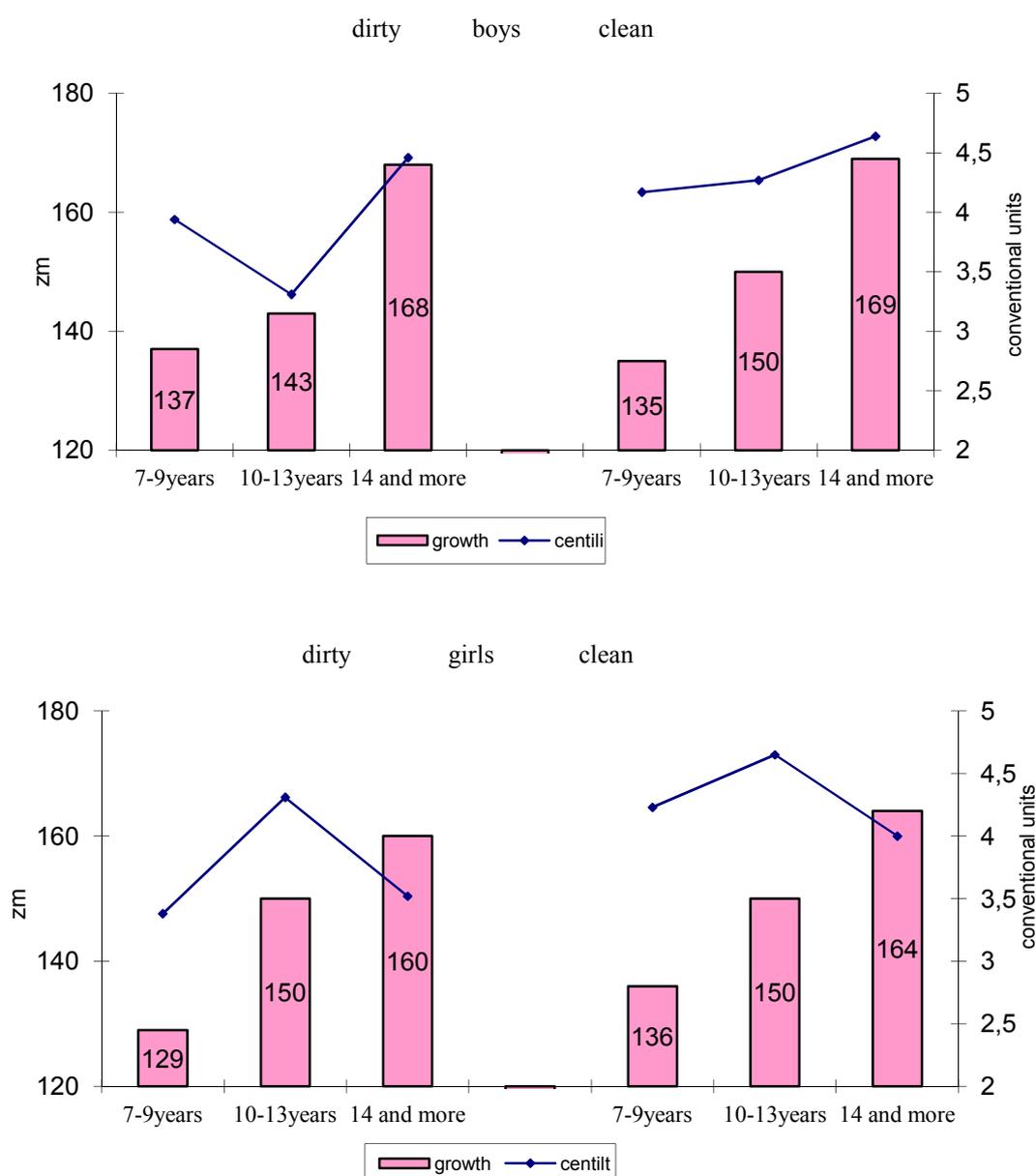


Figure 1. Dynamics of growth and centile growth of schoolchildren according to gender, age and residence place

The boys of both groups of all ages corresponded to the «average» level (0.53 ± 0.68 standard units), while the girls «dirty» area corresponded to the «medium» level and «clean» area — the level «above average» in accordance with the gradation of physical condition index (Fig. 2). Despite the fact that the group fell in different ranges of quantitative gradation under the gradation, significant differences were observed only in the second age group of boys and girls only in the first age group ($p < 0.05$). Large values, and consequently the positive in the physiological sense, noted in «clean» area.

No significant differences according to sex and age from the muscle strength is not revealed, except two boys age group, where the figure was significantly higher among schoolchildren living in the zone of relative environmental well-being (19.4 ± 0.02 kg in the «dirty» area and 22.3 ± 0.92 kg in the «clean») ($p < 0.05$). In general, the dynamics of change in muscle strength consist with the age peculiarities of the students organism.

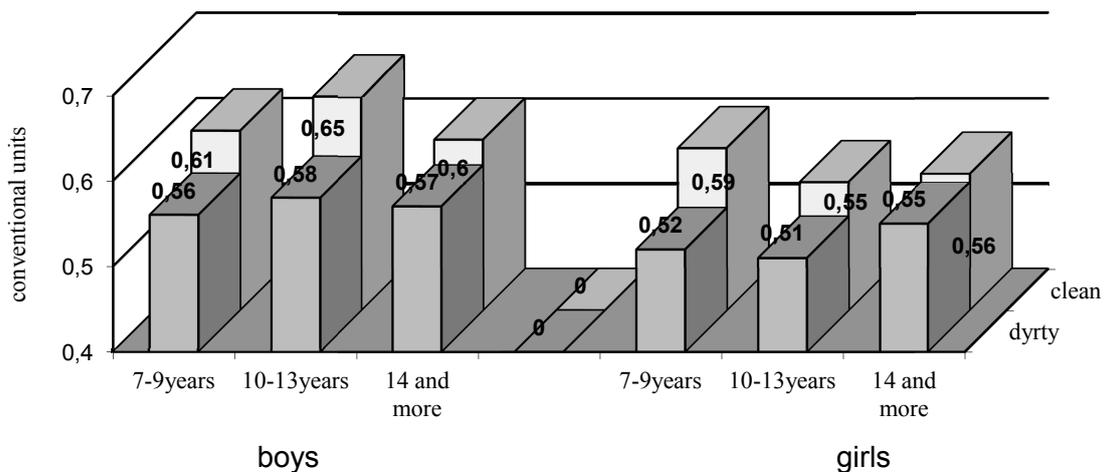


Figure 2. Dynamic of Index of physical condition changes in schoolchildren according

Dynamics of changes in lung capacity is also consistent with the age peculiarities and the differences had the environmental reasons. Significant differences were found in boys of the second age group (10–13 years), where «dirty» area of LC averaged 2223 ± 65.2 ml, while in the «clean» area it already amounted to 2516 ± 95.3 ml ($p < 0.05$). Significant differences were observed among girls in the second and the third age groups. The values of lung capacity were more in the «clean» area.

The results showed that the quality of the environment has a significant influence on the health indicators child's body. At the same time, the leading indicator of the health of schoolchildren is a physical development. The level of this value is closely related to the ecological and socio-hygienic living conditions, it is sublimit to biological laws and reflects the general patterns of growth and development under the environment influence [6–8].

The investigated groups formed on the basis of a copy pair, showed that the mean values of anthropometric indicators of affected area children lower than that of students living in the «clean» area. At the same time, girls than boys are more sensitive to the effects of environmental pollution.

Studies have shown that the ecological situation by place of residence greatly influences on the level of tension systems of the students body.

Significant differences in the age dynamics in children depending on the residence zone were diagnosed by the central nervous system performance. Simple reaction time to visual and auditory stimuli (visual motor reaction and auditory motor reaction) proves this fact (Fig. 3).

Moreover, if the VMR values were higher in students «dirty» areas than in «pure» area, then the AMR differences were diametrically opposed. Significant differences were noted in boys as in AMR, as well as from VMR, the girls only AMR. The general trend of changes in these indicators was such that as the time of reflex reactions decreases and is more pronounced in children living in the «dirty» area from the side AMR

($p < 0.05$). Speed characteristics of nerve impulse flow regulation in the subcortical level indicate a high rate of processes that provide motor activity of schoolchildren living in the «clean» area.

Significant differences were found from the side blood pressure and high values of systolic blood pressure (SBP) and diastolic blood pressure (DBP) were noted in school «dirty» areas, although not all of these differences were significant.

For example, significant differences SBP in boys were found in 3 age group (14–16 years), DBP — in the first (7–9 years).

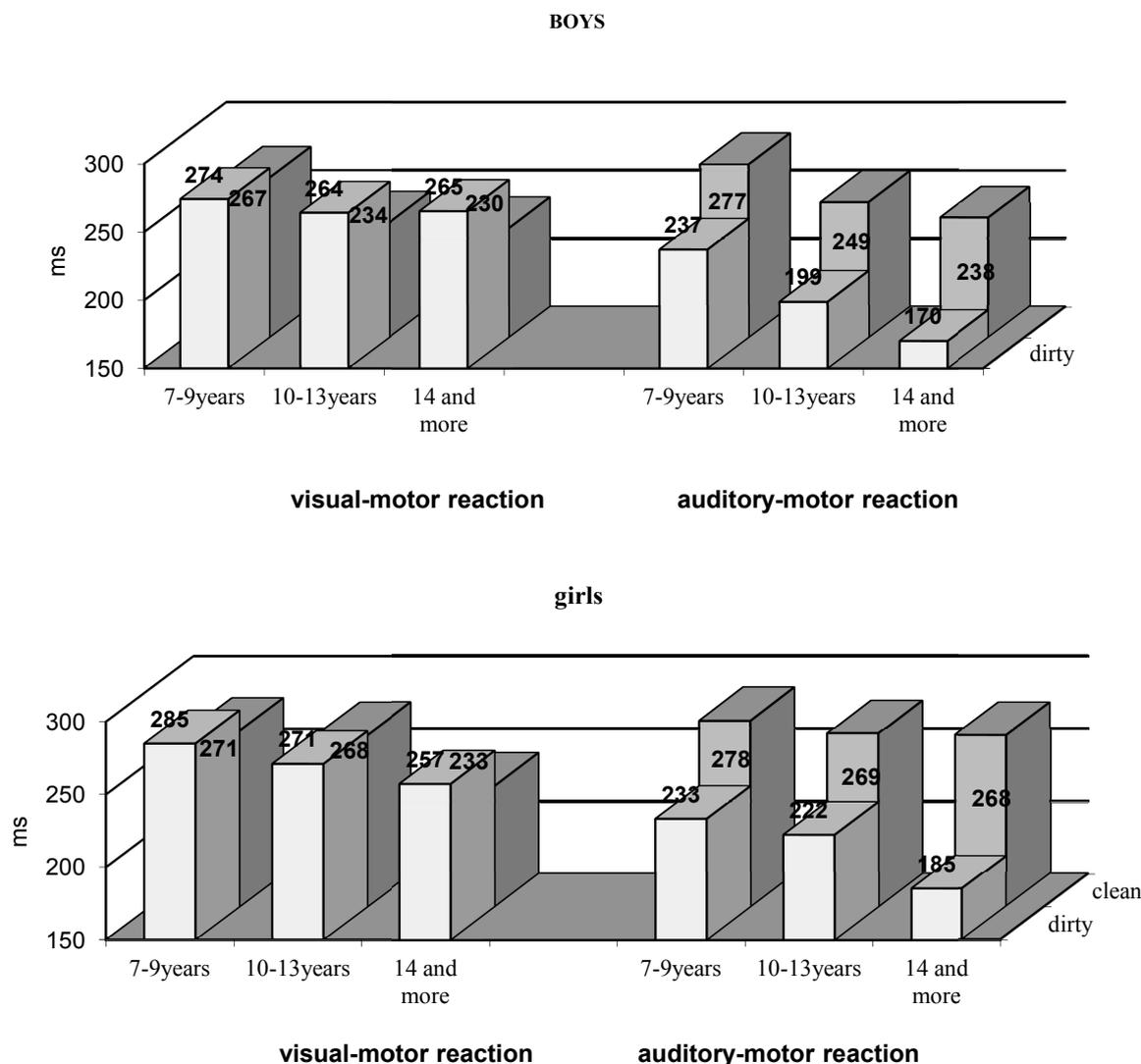


Figure 3. Dynamics of reflex reactions among schoolchildren, depending on residence area

Significant SBP differences in girls were observed in 1 and 3 age groups, DBP — in the 1st and 2nd. However, all indicators were in the area of age norms, which doesn't show a pronounced negative impact of environmental factors. The high value of SBP were noted in boys third age «dirty» area of 118.5 ± 1.38 mmHg, while in the «clean» the area it was 108.0 ± 1.81 mmHg ($p < 0.05$). This is due to the fact that environmental factors play a significant role in the functional status of the individual age groups that have different sensitivity to the impact of negative factors. This is confirmed by V.V.Boldyrev et al. [9], according to which value the contribution of environmental factors in the development of these negative effects is largely dependent on the age of the studied contingent.

No significant differences in heart rate at the school the first age group were noted. In the second age group differences only in girls. And in the third age group, significant differences were found in both groups. Large values of heart rate were noted in «dirty» area schoolchildren. Similar dynamics was observed and

Rufe index, which indicates higher efficiency in schoolchildren living in the zone of ecological well-being. The exceptions were the boys of the first age group for which the index Rufe in «clean» areas were significantly higher than in the «dirty» area. Thus deterioration of the functional state of the cardiovascular system to the standard physical activity in children living in contaminated areas have been identified. Physical performance is included in the concept of the student functional state, it is an integral expression of the body reserve capacity and serves as a reliable test for the evaluation of the cardiorespiratory system functional state in children exposed to adverse environmental conditions at the residence place.

Identified deviations of the organism functional state in schoolchildren from contaminated areas associated with nonspecific action on the body of harmful environmental factors that can be considered expression of protective and compensatory reactions aimed at its optimum adaptation to the environment.

From the analysis of the psychophysiological indicators dynamics it is clear that on the whole the systems adequately respond to emotional stress. But despite this, the different systems have their own characteristics. One such system was central nervous system. The results showed that the degree of central nervous system expressiveness response to examination stress is directly dependent on the environmental conditions at the place of schoolchildren residence, however, this was not always significant differences.

The ecological situation by place of residence is reflected in the dynamics of the critical fusion frequency (CFF) during the exam, and these differences have not had negative connotation. CFF values were higher in schoolchildren living in the «dirty» area than «clean» area, that is adaptive capacity to the effects of stress factors in schoolchildren «dirty» area is above.

Studies in the groups formed on the principle of the copy-pair indicate that girls more sensitive to the effects of environmental pollution than boys. Analysis of morbidity showed that children living in areas of ecological trouble, it was 28.7 % were infected to 71.3 % not infected, in the «clean» area was 20.4 % to 79.6 % (Fig. 4).

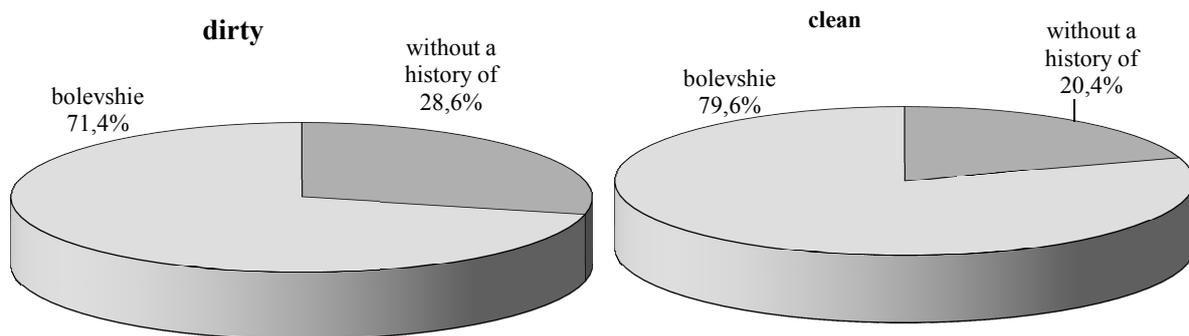


Figure 4. Proportion of children infected and not infected, depending on the residence

It was revealed that all morbidity indicators of children living in the zone of ecological trouble reflect the overall reduced level of students organism resistance. This is evidenced by such indicator as a health index, which reflects the ratio of never uninfected children to the population size for the year. Health Index in the «dirty» area was lower than in «clean». The gender and age characteristics affect the health index difference.

Contamination of the environment has a direct effect on the functional status of schoolchildren to a lesser degree, but can be considered as the initial cause of reduced organism resistance, morphological and functional disorders systems. Moreover, environmental factors can exacerbate the effects of other risk factors, since superimposed on the other factors, including environmental, can under certain conditions cause the launch of pathological processes in the child body. This is confirmed by the results O.V.Tulyakova, M.S.Andreev [10] have established correlation between respiratory disease and the degree of air pollution by harmful substances.

Correlation analysis showed that the level of the schoolchildren functional state depends largely on the age, anthropometric indicators, as well as their derivatives settlement — the index of the physical condition and the adaptive capacity. At the same time the differences among schoolchildren, depending on the degree of ecological trouble by residence place are clearly visible. Thus, no significant differences in age and height

in the studied groups were noted (mean percentage contribution to total dispersion was 17.0–18.2 %). However, differences were noted in other factors, the more pronounced in derivatives settlement — the physical condition index and the adaptive capacity.

Unfavorable environmental situation has a negative effect on physiological indicators and «quality» of the child population health. The degree of energy reserves mobilization is higher in schoolchildren residing in the zone of ecological trouble. The most pronounced differences were noted among schoolchildren in the third age period of 14–16 years.

It was found that children living in the zone of ecological distress have indexes of morbidity that reflect the generally low level of resistance in children. At the same gender and age characteristics influenced at the difference.

Unfavorable ecological situation by residence place greatly affects the schoolchildren body's physical development, it causes stress compensatory-adaptive mechanisms. As a consequence, it is further reflected in the performance and health indicators of the younger generation.

Conclusions

1. Unfavorable ecological situation having a negative impact on the level of physical development, the dynamics of physiological parameters in the process of life. It causes lower performance, high functional stress the cardiovascular system and central nervous system of schoolchildren living in the ecological trouble zone.

2. The process of adaptation to the students' learning, living in different ecological zones of well-being, followed by periods of tension expressed in the cardiovascular system functional state. Functional stress in «dirty» area correspond to the level of pronounced tension and overvoltages, in «clean» it was pronounced stress.

3. Morbidity with temporary disability schoolchildren living in the area «of ecological trouble» reflect the overall low level of body resistance, compared to the control. It shows a pronounced negative impact of environmental factors on the adaptive capacity of the organism teenagers to habitat conditions.

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Ш.М.Нугуманова, А.М.Олещенко, А.Г.Проженник

Атмосфералық ауаның ластану жағдайында оқушылар ағзасының функционалдық ауытқуларына баға беру

Мақалада қоршаған ортаның ластануы балалар ағзасының функционалдық жағдайына жағымсыз әсерін тигізеді. Қоршаған ортаның жағымсыз жағдайлары тұрғындар денсаулығына зиян келтіріп, аурушандық деңгейін жоғарлатады, балалардың физикалық дамуын тежейді. Қоршаған ортаның зиянды факторлары балалар ағзасының функционалдық жағдайына, функционалдық ширығуының жоғарғы деңгейде болуына әкеледі. Авторлар әр түрлі экологиялық аймақта мекендейтін оқушылардың бейімделу үрдісі жұмысқа қабілеттілігі төмендететінін анықтаған. Лас ауданда тұратын оқушылардың функционалдық ширығуы жоғары деңгейде болды. Оқушылардың аурушандық көрсеткіштері бойынша лас аудандарда тұратындарда ағзаның ауруларға қарсы тұру деңгейі төмен, яғни, жағымсыз экологиялық факторлар балалардың бейімделу әрекеттеріне кері әсерін тигізетіндігі дәлелденген.

Ш.М.Нугуманова, А.М.Олещенко, А.Г.Проженник

Оценка функциональных сдвигов у школьников в условиях загрязненного атмосферного воздуха

В статье отмечено, что неблагоприятная окружающая среда негативно сказывается на уровне физического развития и функциональном состоянии организма детей, обуславливая высокую степень их функционального напряжения. Показано, что процесс адаптации у школьников, проживающих в различных по экологическому благополучию зонах, сопровождается снижением работоспособности. Функциональное напряжение организма детей, проживающих в загрязненном районе, по данным авторов, соответствовало уровням резко выраженного напряжения и перенапряжения. Доказано, что показатели заболеваемости школьников, проживающих в зоне загрязненного района, отражали пониженный уровень сопротивляемости их организма и свидетельствовали о негативном влиянии неблагоприятных факторов на приспособительную деятельность организма подростков.

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