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A.E.Konkabaeva, G.V.Sviderskaya, B.A.Kanaphina, A.K.Ramazanov, A.S.Sarsembaeva

E.A.Buketov Karaganda State University

ESTIMATION OF PHYSICAL DEVELOPMENT AND ADAPTATION POTENTIAL OF STUDENTS FROM INDUSTRIAL REGION (ON THE EXAMPLE OF TEMIRTAU TOWN)

Өндірістік аймақта (Теміртау қаласы) тұратын студенттерге зерттеу жүргізілді. Антропометрикалық көрсеткіштер, физикалық даму деңгейі, жұмысқа қабілеттілік және бейімделгіш потенциалы анықталды. Бейімделу механизмдеріне күш түсуі экологиялық жағдайға байланысты болуы ықтимал.

Проведено обследование студентов из промышленного региона (город Темиртау). Определены антропометрические показатели, уровень физического развития, работоспособность и адаптационный потенциал. Выявлено напряжение механизмов адаптации, что, по-видимому, обусловлено экологической ситуацией.

Environment and the background made by it are the main factors of active influence on human health. Health is considered as a bond of population health level with body abilities [1]. Numerous researches of population health level bond with various factor impacts convincingly show that the pollution of the environment unfavorably influences on population health. Environment factors play considerable role in population health level as a whole and especially in separate age groups as separate groups and categories of population have different sensitivity to various factor impacts [2].

Researches of various authors show that in polluted industrial regions significant changes in health level of different population categories are observed. Thus in some European countries delay of bone maturation of children and teenagers are found out [3]. In the group of teenagers subjected to influence of sulfurous substances from pulp and paper production the tolerance of hypoxemia, reserves of cardiorespiratory system, central temperature of body and level of physical health are reduced [4].

Unfavorable situation is generally stipulated by negative impact of unfavorable factor complexes of natural — anthropogenic character. In view of ecological situation deterioration one of the main direction in scientific researches of recent years was population health level under the influence of different ecological factors [5–7].

Environment factors play significant role in population health level as a whole and especially in separate age groups as separate groups and categories of population have different sensitivity to impact of harmful factors and the role of the same factors considerably differ [6].

Central Kazakhstan is not an exception it is one of the leading industrial regions in republic, representing territorial — production complex with developed heavy industry. This is coal — metallurgical and chemical and machine — building region of international meaning in republic. On the basis of territorial — production complex the powerful Karaganda — Temirtau industrial center lies [8].

In view of it the object of our research were inhabitants of Temirtau, situated in central part of Kazakhstan and representing typical large industrial region with area of 10 000 square km and population in 176 000 people. In Temirtau enterprises of ferrous and nonferrous metallurgy, energy, building and food industry are situated [9].

Analysis of contribution in anthropogenic atmosphere pollution of separate enterprises at average per year show that weighty part is for «Mittal Still Temirtau» [10].

Today criteria of harmfulness and factor activity levels of environment are not completely defined and establishment of which will allow to solve problems of environment quality improvement and people's life

conditions in a new way, to find out that part of population which have more risk influence of environment factors [11].

The aim of the work is the ecological factors impact estimation of Temirtau on the dynamic of functional indices of students.

Material and methods of research

The work was made on the basis of biological — geographical faculty of E.A. Buketov Karaganda State University. In the research took part 100 students at the age of 17–21 having no expressed abnormalities in health level. Researches were made in the first part of the day (from 9⁰⁰ till 14⁰⁰) individually with each student.

For examination 2 group of student were chosen: 1st group — students from ecologically safe districts (South — East, Karaganda), 2nd group contains students permanently living in Temirtau where functions powerful industrial complex «Mittal Still Temirtau» situated in town boundaries.

Estimation of physical development (PD) included measuring of length and mass of body, frequencies of cardiac contraction (FCC), chest circumference (CC) on breath and expiration, for arterial pressure (AP) measuring the sphygmomanometer of Riva-Rochi with phonendoscope was used, frequencies of breath for a minute. With the help of Colleen's dynamometer the muscle strength quotient was calculated [12]. Index of physical efficiency was estimated with the help of Harvard step-test (IHST) [13]:

$$IHST = AH * 100 / (P_1 + P_2 + P_3) * 2, \quad (1)$$

where A — age; H — height (cm); P₁ — FCC from 60th till 90th seconds; P₂ — FCC от 120th till 150th seconds; P₃ — FCC from 180th till 210th seconds.

Results were calculated according to data of table 1:

Table 1

Diapason of physical efficiency index meaning

Very bad	Bad	Satisfactory	Good	Very good	Excellent
below 50	51 — 60	61 — 70	71 — 80	81 — 90	above 91

Adaptation potential (AP) of cardiovascular system was calculated by formula [14]:

$$AP = (0,011 * FCC + 0,014 * SAP + 0,008 * DAP + 0,014 * A + 0,009 * MB - 0,009 * H) - 0,27 \quad (2)$$

Where FCC — frequencies of cardiac contraction; SAP — systolic arterial pressure; DAP — diastolic arterial pressure; A — age; MB — mass of body (kg); H — height (cm).

AP of students were estimated by table 2:

Table 2

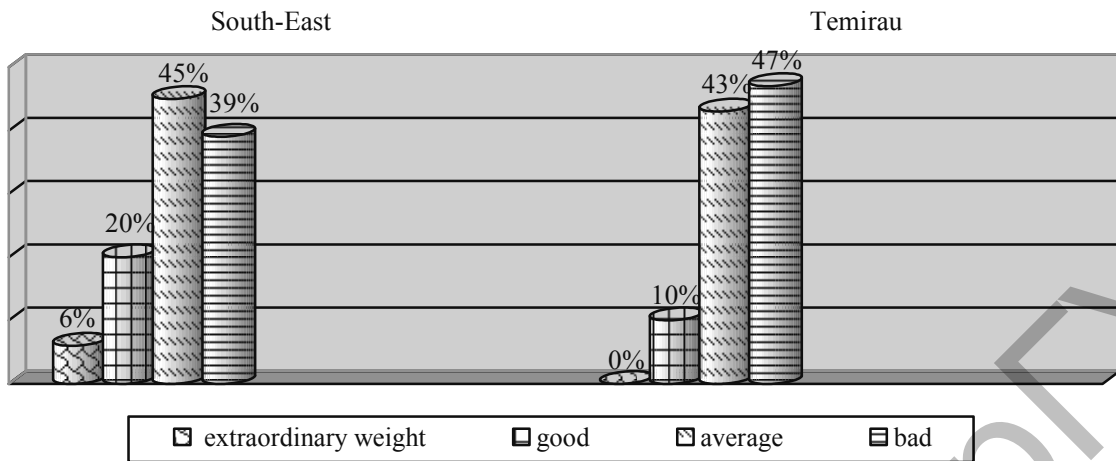
Diapason of adaptation potential meaning

Satisfactory adaptation	Pressure of adaptation mechanism	Unsatisfactory adaptation	disruption of adaptation
2,1 points and below	2,11 — 3,20 points	3,21 — 4,30 points	4,30 and above

For result processing the method of static processing with packet of applied program Excel was used.

Results and their discussion

One of the main characteristics of PD is the definition of general parameters of body proportion and constitution. But for objective estimation of PD the comparison of different anthropometric features has important meaning, therefore we used weigh-height index of Kettle [15], that allowed to find out differences in PD of students in examined groups (pic.1).

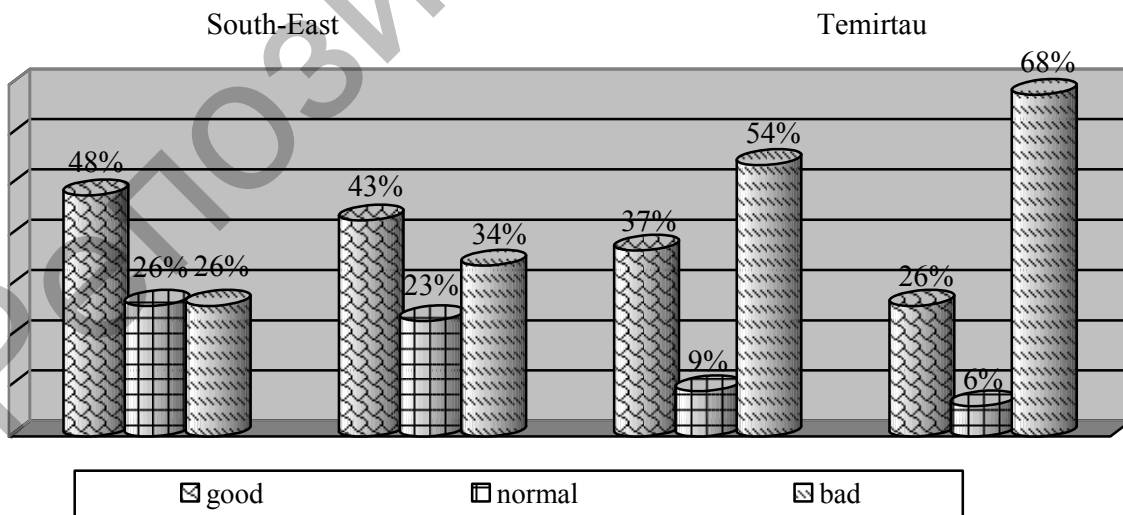


Pic. 1. Quotient of plumpness by weigh-height index of Kettle

In the 1st group we found out that 6 % of students had extraordinary weight by Kettle index, in the 2nd group the students with such quotient were not found. From Temirtau quotients of good plumpness were found out only in 10 % of cases, and in the control group it is twice more. Average quotient of plumpness in the 1st and 2nd groups is approximately equal, it is 45 % and 43 % accordingly. 39 % of students from control group and 47 % from ecologically harmful district have bad plumpness.

Thus by obtained results we can confirm that about half of examined students from ecologically harmful districts have bad plumpness as much as average. And only small percent of examined ones showed good plumpness. Undoubtedly bad plumpness is firstly connected with the quality and quantity of nourishment but toxic influence of environment factors in this case influence of xenobiotic can not be excluded which can change activity of ferment system on the level of cells and abnormalities of absorption process in gastrointestinal tract.

Index objectively characterized mass of body and muscle strength is the dynamometry with the help of which strength of right and left hand is defined (pic.2). There is a definite dependence between mass of body and muscle strength. Usually the more muscle mass the more strength.



right hand left hand right hand left hand

Pic. 2. Quotient of dynamometry

Conducting of dynamometry allowed us to find out following peculiarities of students from ecologically harmful regions. Muscle strength of right hand was defined as good in 37 % while in the control group it was

48 %. Normal quotient was found in 9 % of students from Temirtau that in 3 times less than in control group. Bad quotient was 54 % that in 2 times more than in control group.

Thus obtained results indicate about reduction of muscle strength of hand of more than half examined students from ecologically harmful region that conform to given above parameters.

Function of cardiovascular system (CVS) easily change under different environment influences on organism, it actively take part in all processes of vital activity reacting to the slightest changes of separate organ requirements [16]. In a view of it the CVS parameter measuring has important meaning for estimation and prognostication of functional level of the whole organism. Quotients of arterial pressure and FCC in the quiescent state of students from both examined groups were in the limit of norm according to their age [13]. Along with it after physical activity the rehabilitation period was estimated as satisfactory in both groups (tab 3).

Table 3

Quotients of cardiovascular system of students from different regions

Region	SAP	DAP	FCC before exercise	FCC after exercise	FCC in 1 min after exercise	FCC in 2 min after exercise	FCC in 3 min after exercise
Temirtau	107,143 ± 10,167	67,857 ± 6,335	72,514 ± 5,321	115,829 ± 4,322	90,457 ± 7,097	79,714 ± 3,762	73,371 ± 3,59
South – east	106,522 ± 9,273	65,87 ± 7,346	72,522 ± 4,089	114,522 ± 5,986	90,565 ± 6,931	78,089 ± 4,082	72,826 ± 3,76

For estimation of cardio and respiratory system tolerance we calculated index of physical working capacity of organism with the help of widespread Harvard step-test (tab 4)

Table 4

Index of physical working capacity

Name of group	Very bad	Bad	Satisfactory
1 st group	0 %	35 %	62 %
2 nd group	3 %	54 %	43 %

According to results obtained after conducting Harvard step-test it was found out that bad physical working capacity had been in 3 % of students from the 2nd group, among the students from the 1st group it was not found. Bad physical working capacity was among students from Temirtau and contains 54 % and students from control group had 35 %. Satisfactory physical working capacity was in 65 % of students from control group and in 43 % of students from ecologically harmful regions.

Obtained results indicates about lower physical working capacity among students from Temirtau that is conditioned by totality of obtained results during the research of physical working capacity particularly meanings of weigh — height index of Kettle to dynamometry quotient.

State of the whole organism as a result of functional system activity is defined by optimality of controlling influences, capacity of controlling mechanisms to provide balancing of organism with environment, its adaptation to environment conditions. Adaptive activity of organism needs expenditure of energy and information therefore one can speak about «the value of adaptation» which is defined by level of regulatory mechanism pressure and size of spent functional reserves. Occurring in the adaptation process change of functional system level or its elements don't always lead to homeostasis abnormalities until overstrain of regulatory mechanisms appear and functional reserve exhausts [17].

There is no doubt that harmful ecological condition play key role in adaptation processes of organism. But during long influence of homeostasis self-regulation mechanism abnormalities, reduction of adaptive reserves of organism and consequently appearing of various pathological changes of functional system can be observed. Under mobilization of adaptive possibilities of organism first of all the cardiovascular system reacts. Thus we defined AP of CVS by formula [14] (tab. 5).

Table 5

Adaptation potential

Name of group	Satisfactory adaptation	Exertion of adaptation mechanism
1 st group	81 %	19 %
2nd group	61 %	39 %

Adaptation possibilities of organism are the indicator of health level. They are defined by the level of organism adaptation to the environment. Following states of organism are sorted out: state of satisfactory adaptation; state of adaptation mechanism exertion (changeable and incomplete adaptation); state of unsatisfactory adaptation; state of adaptation breakdown (exhaustion of adaptation mechanisms). During the research only 2 states of organism were found: state of satisfactory adaptation and state of adaptation mechanism exertion (changeable and incomplete adaptation).

Indices with satisfactory adaptation were among the students in the 1st group and were 81 % and among the students of the 2nd group they were in 20 % less. Adaptation mechanism exertion was in 39 % of students from Temirtau and 19 % students from control group.

Thus obtained results show that the students from ecologically harmful regions have less percent cases of satisfactory level of adaptation but high level of adaptation mechanism exertion. According to Baevskiy R. M. change from one physical norm to pathological states passes number of stages on which organism tries to adapt to environment by changing functions of separate organs and system levels. Passing into more adequate level of functioning needs definite level of regulatory mechanism exertion directed to mobilization of functional reserves. The more level of regulatory mechanism exertion the lower functional reserves of organism [17]. Overstrain of regulation system can lead to adaptation breakdown and changes of functioning level of organism main systems and accompanied by pathological syndromes and diseases. Ability of organism to adapt depends on possibilities of functional organism reserves.

Harmful impacts of environment influence greatly on general state of organism. Based on obtained results one can confirm that defective mass of body, low level of physical development are caused by other reasons and environment. Adaptation mechanism exertion of examined students can further generate breakdown of adaptation with inadequate changes of organism main system functioning level that needs extra researches and application of corrective technologies in these groups.

Conclusions

1. Harmful ecological situation in Temirtau negatively reflects on general state of organism and causes adaptation mechanism exertion among students.
2. Weak physical development and low working capacity found among students from Temirtau along with other reasons are conditioned by ecological situation.

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Н.М.Дузбаева¹, Л.Т.Базелюк², А.К.Зейниденов¹

¹Карагандинский государственный университет им. Е.А.Букетова;

²Национальный центр гигиены труда и профессиональных заболеваний МЗ РК, Караганда

СОСТОЯНИЕ МЕТАБОЛИЧЕСКОГО СТАТУСА СЛИЗИСТОЙ ОБОЛОЧКИ НОСА, БУККАЛЬНОГО ЭПИТЕЛИЯ ЩЕК И ПЕРИФЕРИЧЕСКОЙ КРОВИ У ДЕТЕЙ, ПРОЖИВАЮЩИХ В РАЙОНАХ ТЕХНОГЕННОГО ВЛИЯНИЯ

Мақалада техногенді әсер ететін аудандарда тұратын балалардың мұрындағы шырышты қабығының, ұртындағы буккальді эпителийінің және шеткі қанының метаболизмдік деңгейінің жағдайы ортаның жағымсыз факторларының әсерінде мұрын мен ауыздың эпителийді қабығының цитологиялық жағдайы өзгеріске ұшырайтыны туралы айтылған. Жұмыстың мақсаты — жоғары деңгейде ластанған аудандарда тұратын балалардың жоғарғы тыныс алу жолдарындағы шырышты қабықтың және шеткі қанның метаболизмдік өзгерістерін зерттеу. Зерттеуде ірі өнеркәсіптік қалада тұратын балалардың мұрын мен ауыз қуыстарындағы шырышты эпителийінің кедергілік қызметінің бұзылуы және нәтижесінде жоғарғы тыныс алу жолдарының созылмалы патологиялары дамуына жағдай туындайтыны анықталды.

The article condition metabolic status of the mucous shell of the nose and buccal epithelium cheeks and peripheral bloods beside childrens living in region technogenesis influences is given cytological state mucous shell to cavities of the nose and mouth, changing under disadvantage influence surrounding ambiances. The purpose of the studies is a study of the metabolic change mucous shell of the upper respiratory ways and peripheral bloods beside childrens living in region with high level of the contamination. As a result of studies are discovered that beside childrens living in large industrial city is violated barrier function epithelium nose and mouth. As a result this is the condition for development of chronic pathology of the upper respiratory ways.

Одной из особенностей экологически обусловленных интоксикаций является латентный период, в течение которого происходят метаболические изменения как ответ на постепенное накопление ксенобиотиков. Кумуляция ксенобиотического фактора в организме проявляется на первом этапе реакцией адаптации, трансформирующейся затем в предпатологические изменения, которые в последующем дают основания для развития патологии [1].