

THE EVALUATION OF COAL MINERS' BLOOD CELLS RESISTANCE UNDER THE DUST AEROSOLS INFLUENCE

L.K. Ibrayeva MD, I.A. Amanzhol MD

The national center for occupational hygiene and occupational diseases, Karaganda, Kazakhstan

Under present-day conditions, while new economic relations are developing and forms of property are modifying, the health preservation of workers in essential industries became more difficult. The health analysis of people, who working under the harmful industrial conditions, argues the maintaining of a high level of occupational diseases in leading industries. The socio-economic compensation for their health damages requires large expenditures.

Generally, the existing methods of dispensary and clinical examination are focused on the diagnosis of nosological pathologic forms and don't allow to recognize and differentiate prenosological states. The examination of "almost healthy people" shows that the highest incidence of the adaptive mechanisms' stress and their disruption accounts for workers aged 20–40 years.

THE PURPOSE

is the stability rating of coal miners' blood cells under the dust aerosols influence.

MATERIALS AND RESEARCH METHODS

As a result of our experimental research there were devised diagnostic approaches, which characterize the tolerance of organism to the dust aerosols effects. There were revealed that the main effect under the influence of different types of fine dust aerosols is a violation of the cell membranes integrity, which leads to the development of pathological states of experimental animals in different body systems. A erythrocytes stability determination to haemolysis is the main method, which available to detect the presence of the membrane damaging effect under various xenobiotics influence. In our experiments there were revealed that under different kinds of fine dust dust aerosols influence already since the early timing the erythrocytes stability to haemolysis has been decreased, which indicates the presence of the membrane damaging effect.

There were tested 290 people. 270 of them are almost healthy workers from the Karaganda mine



Lyazat K. Ibrayeva
Associate Professor,
Head of the Department
of Management of Scientific
Research, Head of Toxicology
Laboratory
lyazat1967@gmail.com

named after Kostenko with different work experience (113 drifters and 157 breakage face miners), working under the most adverse conditions (dust 90–150 mg/m³), and 20 healthy donors who do not have and had no contact with the dust during their careers. The examined people age was within 20–50 years old. Every examined person didn't have a history of chronic diseases. The selection of the miners was conducted during a medical examination in the medical unit "Ispat-Karmet." The control group includes 20 donors. Drifts and breakage face miners were divided into groups based on the length of their work experience with 5 years step.

Every selected individual (miners and donors) was determined full blood count (hemoglobin, hematocrit, red blood cell count and white blood cells) by the usual method [1] with the hematology analyzer System KX-21N (Japan, 2006), erythrocytes stability to haemolysis, which indicates a violation of the cell membranes stability by Jager FC [2] SF-2000 with the CF-2000 spectrophotometer (Russia, 2006).

The statistical analysis of the material was hold with a PC Pentium IV using the «Statistika 5.0» application package. There were performed the calculation of the reliability coefficient (P), which was estimated from the Student value, table test (t) of the ANOVA, correlation analysis, regression analysis, factor analysis [3–6].

RESULTS OF OWN RESEARCHES

The drifters who have been working in the dust under 20 years of the hemoglobin level was above the control level by 10-11%, and who have been worked over 20 years – above 12%. The number of red blood cells in all the drifters experienced groups was 6–8%

lower than in the control group. The hematocrit of drifters who have been working in the underground dust under 10 years was not significantly different from the control group, and at the experience of 11–20 years it became 23% higher than in the control group, indicating the blood clots development. At the same time drifters in 11–15 years experienced group have hematocrit of 20% more than in 6–10 years experienced group, and in 20 years experienced group it have grown by 8% compared to 11–15 years experienced group. The level of hemolyzed erythrocytes of the drifters who have been working up to 20 years was higher than control in 3 times, and have worked over 20 years – in 2 times. At the same time in comparison with previous groups there weren't observed any significant changes in drifters erythrocyte haemolysis (Table 1).

face miners' haemolysis level of red blood cells was higher in 2 times than it in the 20 years experienced group, and 76% more than it in the more 20 years experienced group. Comparing the level of red blood cells haemolysis with a previous experienced group of breakage face miners, as well as between similar groups of stope miners and drifters there were found no significant differences (Table 1).

Using a pair of correlation analysis it is confirmed that with increasing doses of received dust, that is length of career, the degree of red blood cells hemolysis increases ($r = 0,153$), which indicates the presence of dust effect which damages membranes. The drifters in major had leukopenia ($r = -0,430$), haemolysis of red blood cells ($r = 0,356$) and blood clots ($r = 0,408$).

Table 1. The blood picture of breakage face miners and drifters by experienced groups

Groups	Leukocytes, * 10-9 / l	Hemoglobin, g / l	Erythrocytes * 12.10 / L	Hematocrit, ml	Haemolysis,%
Control	7,20±0,148	140,5±1,16	5,35±0,130	0,40±0,006	1,280±0,072
Drifts	5,17±0,167*	155,2±2,60*	4,97±0,088*	0,41±0,007	4,352±1,619
	5,11±0,094*	155,9±1,38*	5,01±0,035*	0,41±0,009	4,088±1,099*
	5,12±0,076*	156,6±1,12*	4,97±0,041*	0,49±0,008*#	3,369±0,747*
	5,26±0,053*	155,1±1,93*	4,92±0,056*	0,49±0,006*	4,195±0,838*
	4,95±0,059*#	156,9±0,63*	4,98±0,026*	0,53±0,009*#	2,855±0,559*
Breakage face miners	4,85±0,119*	153,3±0,73*	4,77±0,037*	0,41±0,012	2,660±0,535*
	4,95±0,065*	154,8±0,95*	4,93±0,035*#	0,41±0,006	2,626±0,595*
	5,15±0,077*	156,7±1,27*	5,00±0,044*	0,44±0,011*#^	2,927±0,477*
	5,20±0,065*	157,4±0,66*	5,00±0,026*	0,48±0,007*#	2,735±0,490*
	5,09±0,070*	157,5±0,51*	4,97±0,048*	0,48±0,005*^	2,256±0,283*

Note: The accuracy compared with the control – *; with the previous experienced group – #, with a similar drifters group – ^.

The hemoglobin level of stope miners with the experience under 10 years was higher than controls at 9–10%, and with the experience 11 years or more it became by 12% of control values. The number of erythrocytes was reduced on 11% relative to control in stope miners, who have been working less than 5 years, and who have been working 6 years and more has been below 8.7% in controls. The level of hematocrit at the stope miners 10 years experience was not significantly different with the control, and with a length of 11–15 years it was 10% more than in the control.

At the same time stope miners with 11–15 years experience have hematocrit level which is 10% lower than a similar group of drifters. In 11–15 years experienced group the hematocrit became 17% more than in 6–10 years experienced group, and with the 16–20 years career – 9% more, than at the 11–15 years experience. In addition, breakage face miners with more 20 years experience had level of hematocrit which was 9% lower than in the same group of drifters. All breakage

Thus, even with a 5 years career as drifters', as stope miners' hemoglobin levels increased and the number of white blood cells reduced. However, the drifters with the more than 20 years experience have progressed leukocytes reducing by 6% compared with 16–20 years experience. In the 11–15 years experienced group there was a hematocrit increasing by 23% for drifters and by 10% for breakage face miners. In the sequel with increasing the length of the dust experience in both cases there was a hematocrit increasing by 8–9% compared with the previous experienced group, with the difference that for drifters it occurred before the 16 years dust experience, while for stope miners it occurred only after the 20 years dust experience. In less 5 years experienced group the stability of red blood cells to haemolysis have decreased in 3 times for drifters and 2 times for breakage face miners. The findings suggest a more pronounced degree of blood clots, a leukopenia and a decreasing the stability of erythrocytes to haemolysis for drifters.

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