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TRANSLATION:

Alyab'yev, G. A.: PHYSIOLOGICAL NORM FOR TRACE-ELEMENT LEVELS IN MAN.
(O fiziologicheskoy norme soderzhaniya mikroelementov v organizme cheloveka.)
Mikroelem. Biosfere ikh Primen. Sel. Khoz. Med. Sib. Dal'nego Vostoka, Dokl. Sib. Konf., Vol. 2, 1964 (pub. 1967), pp. 549-551 (Russ.). Edited by O. V. Makeyev, Buryat. Khizhn. Izd-vo, Ulan-Ude, USSR. Irkutsk Medical Institute.

ABSTRACT. Mn, Hg, Pb, and Al blood, throid gland, urine, and feces levels were determined in normal human subjects and subjects whose occupations involved contact with these elements. Only traces of Mn, Hg, and Pb were found in the healthy subjects, while the Mn content in the blood was 0.35 mg% and the Hg level was 1.2 mg% in individuals who worked with these elements. An increased Mn content was found in the thyroid glands of subjects afflicted with goiter. No Al was found in either group. Differences between these findings and those of other authors are explained as being due to different biogeochemical conditions.

The need for a solution to the question of normal levels of certain trace elements in man is actually dictated by life itself and above all follows from the demands of the medical profession. A knowledge of the normal human levels of such elements as manganese, mercury, and lead, for example, would assist forensic medical experts and chemists in the diagnosis of household, criminal, and industrial poisonings, and would help industrial physicians and clinicians when conducting preventive examinations and observations of individuals who have contact with these substances.

It should be noted that the current system for organizing labor and medical control in our industry eliminates the possibility of dangerous environmental contamination.

The maximum permissible concentrations of noxious gases, vapors or dust in the air of working areas are governed by special regulations. Prolonged contact with trace amounts of the above-indicated elements, however, may have an

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injurious effect on the individual. Detection of the early symptoms of the action of these substances -- establishing the "pre-pathological" state of the organism -- is often one of the most difficult tasks of the examiner since the clinical signs of poisoning in the initial stage may be very indistinct. Analysis of blood, urine, sputum, etc., for their content of toxins can be extremely helpful in this case [Al'yab'yev, 1961, 1962, 1965].

Chemical methods for detecting noxious substances in man are used extensively in forensic chemistry and toxicology. As pointed out by Lazarev (1954), Gadaskina (1939), Teysinger and other investigators (1959), these very methods can be used for diagnosing occupational and other forms of poisoning.

When the quantities of trace elements detected in man are compared with their normal content, however, specific difficulties arise. The literature abounds in a multitude of information in this regard.

The importance of solving this problem is also substantiated by the indicated use of trace elements as biotics to achieve a therapeutic effect. Each investigator in this case may be unavoidably faced with the task of establishing the critical levels of trace elements in the human body since a decrease or increase of their content in man results in metabolic disorders which frequently lead to serious illnesses.

We attempted to establish the normal contents of certain trace elements in individuals who were healthy for all practical purposes and in subjects who had direct contact with these elements under industrial conditions. The results of the study are given in Table 1.

TABLE 1. MANGANESE, MERCURY, LEAD AND ALUMINUM CONTENT IN MAN.

Trace element	Number of subjects examined	Element content in organs and excrement					
		blood		thyroid gland	urine	feces	
		healthy contact	healthy contact	healthy contact	healthy contact	healthy contact	
Mn (mg%)	70	95	0.01-0.07 up to 0.35	0.10-0.41 1.43	0.02-0.05 up to 15.5	0.8-1.8 up to 14.7	
Hg (mg%)	20	40	0.0 -0.5 up to 1.2	-	0.0 -0.4 up to 39.04	-	
Pb (mg/liter)	76	69	-	-	0.05-0.09* up to 0.47	-	
Al (mg%)	-	6	-	-	-	up to 0.31	

*Rasputin's findings (1961).

Analysis of the findings leads to the following conclusions.

1. The variations in manganese, mercury, and lead contents in the test subjects who had no direct contact with these compounds are insignificant.
2. The subjects who had direct contact with the trace elements (on the job) have definitely elevated levels in their tissues.
3. The manganese content in the thyroid gland of subjects afflicted with goiter is high.
4. Our findings on the normal content of manganese, mercury, lead, and aluminum in man differ significantly from those found in the literature, which is apparently explained by the biogeochemical characteristics of the areas in which our test subjects lived.

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