DETERMINATION OF SOME TRACE ELEMENTS IN HAIR OF DIABETICS BY ENERGY–DISPERSIVE FLUORESCENCE METHOD

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The trace elements are indispensable in human body. Diseases of human body has a direct bearing on the metabolism and equalibrium of the trace elements. Through the determination of the trace elements in human hair, scientific basis are provided for the prevention and cure of diseases. The trace elements in hair of diabetics were analyzed by using ^{241}Am X–ray fluorescence method.

Experimental method: X–ray determinations were performed using a measuring system which consisted of a Si(Li) detector with a window area of 113 mm^2, FWHM–210 ev for 5.9 Kev and a Canberra 4096 multichannel analyzer. ^{241}Am radioisotope of an activity of 1.4×10^9 Bq was used as the source of exciting radiation. The time of measurement was 1000 s. The K_α emission line of each element was used. In order to minimize the interference of Compton scattering, the special instrument was deviced.

The hair of a certain position of diabetics was collected. It was cleaned by the following steps: $\sim$ 30 min in 1% Haiou detergent; wash in distilled water times and again; rinse in deionized water; rinse in alcohol and deionized water. Then, it was desiccated in desiccator, a certain quantity hair was reduced to ashes at high temperature. Then put following material into the ashes: 30 μl of diluted nitric acid, 20 μl of standard solution Y and 10 μl of extended solution. After changing into homogeneous mixture, it was dropped on polycarbonate film. The mass–per–unit–area values of the targets are $\sim$ 2 mg / cm^2 and diameter is 10 mm. Such examples can be regarded as thin layers, the intensity of a characteristic X–ray line is approximately proportional to the concentration of the standard solution of each element. A liner relationship factors were found between the concentration in the standard solution of each element and the concentration of the standard solution Y.

Results and discussion: The hair of 23 diabetics was collected, whose ages are in the range of 14–64 years, and two of them are IDDM, the others are NIDDM.

The majority of them, except individual person, take medicines of different kinds, and are still under the treatment in hospital. The concentrations of Ca、V、Cr、Mn、Fe、Co、Ni、Cu、Zn and Pb elements in human hair were determined by the above described method. The values of main elements are presented in Table 1.

Table 1. The values of main elements measured in human hair   (ppm)

	Zn	Cu	Ca	Fe	Cu / Zn
diabetic	137±14	16.2±2.4	866±87	23.4±3.1	0.118
health	179±18	9.8±1.5	1437±144	20.5±2.7	0.0548

The measured results of the diabetic have been compared with those of the healthy person. The data in Table 1 show Zn of the diabetic is a much lower concentration than the healthy, Cu is higher, and the value of Cu / Zn is larger, and Ca content is lower. The reseans for the lack of Zn of the diabetic are: Owing to the strict control of food and drink for a long time, and the food contained more Zn can not be supplied promptly; The concentration of Zn in urine of the diabetic is more than the healthy, and Zn is lost more; The requirement Zn of a sufferer from diabetes complication is higher than the healthy; Body of daibetics often has injuries, making a quick recovery needs more Zn. Owing to the lack of Zn of diabetics, the capacity of their immunity is much weakened. Thus it can be seen that to build up diabetic's health with nourishing Zn or the food contained more Zn is very necessary, and some diabetes complication can be alleviated and it is also favourable for the prevention and cure of diabetes complication.

Values of several trace elements measured are listed in Table 2. The element Fe、Co、Mn、Pb and Ni contents of diabetics are in agreement with the healthy person within experimental error. Ti and V contents of the diabetics are higher than the healthy person, and Cr content is over two times, and Cr contents of some of diabetics are several times. Therefore, metabolism and equalibrium of the trace elements for diabetics are very important. They affect other metabolism and lead to metabolic disorder.

Table 2 The values of several trace elements measured in human hair   (ppm)

	Ni	Co	Cr	Mn	Pb	Ti	V
diabetic	0.806	1.03	3.07	4.73	5.64	4.13	0.498
health	1.17	0.993	1.44	4.10	5.75	2.78	0.275