Determination of Multi-Elements in Human Hair by Neutron Activation Analysis

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Abstract

Scalp hair from volunteers selected from different areas surrouading Baghdad were collected for study by neutron activacion analysis (NAA).

The results for all element in hair was determined, the elements , are Na, K, Ca, Cr, Co, Zn, As, Sb, and Hg. The elemental concentration was discuced with the past measurment in our institue and the other regions of the world.

Introduction

Hair is increasingly used as a specimen for biological monitoring in occupational, environmental and forensic toxicology. Abnormal concentration of toxic elements like As, Hg, Pb, Se and Sb in hair have, in a number of investigations, served as evidence of exposure to abnormal quantities of these toxic substance[1,6]. To study the significance of hair analysis for body burden the levels of trace elements have been compared with those in blood and urine[6,9] the present study a random 50 samples from rural and urban areas of Baghdad was collected and analysed using. Neutron Activation method the element was Na, K, Sc, Ca, Cr, Co, Zn, As, Br, Sb and Hg.

The HH^{-1} standard samples was used as a reference this study .

Experimental

2-1 Samples Collection

Small plastic bags were used to collect about 1g of hair from each rural populations around Baghdad city, samples were cut as close as possible to scalp. The sample for each individual was taken from two or three spots on the head. About 50 samples were collected from subjects of different age and occupation.

2-2 Washing and Preparation

Washing is performed as recomended by the IAEA adivsory group on hair[10]. The samples were washed with either, acetone, twice with double distilled water and acetone, each time 20 ml solvent is applied. The hair samples are transferred into previously cleaned polythene tube. After washing and drying, the samples are dried an a stream of air. They are then put into clean polythene tubes, cooled in liquid nitrogen and crushed with quartz

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الخلاصة

درست حالة 471 انثى مصابة بخمج المجاري البولية ، راجعت المختبر المركزي في الحلة خلال عام 1995 بأعمار مختلفة بوجود الاعراض او عدمها . اعطى زرع الادرار نمواً معنوياً في 409(86.8%) من الحالات بينما كان 62(13.1%) خالي من النمو . كان مجموع العترات السالبة لصبغة غرام 255(54.11%) وكانت الاشريكية القولونية ، Escherichia coli الاكثر او بنسبة 144(30.7%) تليها المنقلبة Proteus sp. 56(11.8%) الكلبسية Klebsiella sp. 35(7.4%) ، الانتروبكتر Enterobacter sp. 12(2.5%)، الزائفة الزنجارية Pseudomonas aeruginosa 6(1.2%) بينما كانت نسبة وجود البكتريا الموجبة لصبغة غرام 133(28.3%) ، مثلت المكورات العنقودية الذهبية Staph. aureus منها 58(12.4%) تليها العقديات group B-streptococci 25(5.3%) ، العقدية البرازية Strept. faecalis 22(4.6%) العنقودية البيضاء Staph. albus 20(4.2%) بينما كانت نسبة الاصابات المشتركة 21(4.4%) من المجموع الكلي للعزلات ، والشيء الجدير بالاهتمام هو عزل السيراتية Serratia marcescens من 2(0.4%) والعنقوديات الرمامة Staphylococcus saprophyticus من 8(1.6%) من عينة البحث . وتم اجراء فحص الحساسية الدوائية لجميع العزلات وكذلك درست العلاقة بين العمر ، نوع الاصابة ، الحمل ، وظهر ان أكثر المضادات الحيوية فعالية هي الناليديكسك والاريثروميسين والكوليستين في تأثيرها على البكتريا السالبة لصبغة غرام والبكتريا الموجبة لصبغة غرام وبكتريا الزنجارية على التوالي.

rod. These prepared samples was stored in closed polythene flask.

2-3 Irradiation and Counting

About 150 mg of each sample was weight in quartz irradiation capsules. The samples and standard were irradiated for 6 and 72 hr. in the IRT-5000 reactor at neutron flux of $2X10^{13}n.cm^{-2}.s^{-1}$. After irradiation the samples and standard were decay for 4 and 24 days. Prior counting the samples were transfered to clean containers and reweighted. A 30 cm^3 Ge(Li) detector coupled to an on-line computer was used to counting. The counting time was 2000 sec. for each samples and standard. The nuclear data for elements determned are summarized in Table-1.

Results and Discussion

The arithmatic mean concentration for all the elements analysed in 50 bais samples are summorized in Table-2. The second column in Table-2 gives the concentration range of the population excluding the exceptionally high values. The excptional values are given in the last column. The -ray spectra are shown in Fig-1.

The arithmatic mean values for concentration of the elements Ca, Zn, As and Sb is not differ significantly from the reported values for Baghdad and regions of the world[2,11].

The average Br concentration in the hair studied are equal to it is concentrations which is reported in[2] but it is lower than the values reported for other regions of the world, as sumarized in the IAEA report[11]. This may be due the very low consumption of sea food by general Iraq population.

The average Hg concentration in Bghdad area reported in[2] was 1 ppm, in this study the average concentration is 0.4 ppm this mean the Hg decay out during this time, but it normaly lower the values reported for other regions of the world, as summarized in[11] .

This study is the rebeging of using the INAA in biological study .

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Table 1: Element Determined and the relevant nuclear reaction and Gamma lines used

Element	Nuclear reaction	-line used (kev)	Half-life
Na	^{23}Na (n,) ^{24}Na	1368	15.0 h
K	^{41}k (n,) ^{42}K	1524	12.5 h
Sc	^{45}Sc (n,) ^{46}Sc	1120	83.9 d
Ca	^{46}Ca (n, ,β) ^{47}Ca	160	3.43 d
Cr	^{50}Cr (n,) ^{51}Cr	320	27.8 d
Co	^{59}Co (n,) ^{60}Co	1173	5.2 y
Zn	^{64}Zn (n,) ^{65}Zn	1115	245 d
As	^{75}As (n,) ^{76}As	559	26.0 h
Br	^{81}Br (n,) ^{82}Br	776	35.9 h
Sb	^{121}Sb (n,) ^{123}Sb	564	2.75 d
Hg	^{202}Hg (n,) ^{203}Hg	279	46.7 d

Table 2: Determination of Multielement in the head hair by N.A.A. in (ppm)

Element	Arithmetic mean with standard deviation	Range	Exceptional values
Na	25.8 + 89	100.8 - 461.7	550.8 , 627.777
K	41.75 + 25.3	12 - 74	----------
Ca	2859 + 1416	900 - 5300	12500
Sc	0.03 + 0.016	0.015 - 0.06	----------
Cr	0.13 + 0.06	0.05 - 0.209	12.5
Co	0.025 + 0.02	0.004 - 0.045	----------
Zn	191 + 73.6	64.8 - 384.7	400 , 424.8
As	0.496 + 0.57	0.043 - 1.14	----------
Br	3.18 + 4.3	0.38 - 21.6	36.7
Sb	0.18 + 0.02	0.0005 - 0.04	----------
Hg	0.4 + 0.4	0.0366 - 2.05	----------