Determination of levels of some trace elements in teeth samples in Al-Najaf Governorate, Iraq

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Abstract

Essential biological elements are found in trace amounts in both the human and animal bodies. Thus, altering their levels can have serious negative effects, such as poisoning. This study evaluated 40 teeth samples from healthy men and women. Mg, Al, and Fe had significantly more trace element contents in teeth samples than did K and Zn, according to research using X-ray photoelectron spectroscopy (XRF). Teeth levels showed no statistical significance when compared with the mean and concentration of a healthy individual sample, for which a P-value ($P>0.05$) was found. However, a correlation was found between iron and aluminum in teeth samples. The number of teeth tools available may be an important factor in the causes of teeth decay.

Keywords: *trace elements, teeth health, human health, teeth caries, teeth structure.*

Introduction

Carbon, hydrogen, and nitrogen make up around 96% of the components that support life. In a living system, there are quantifiable concentrations of over half of all known elements. 23 elements have recognized physiological functions in people and other animals, 11 of which are categorized as trace elements (TEs)[1].TEs are made up of non-metal elements including selenium (Se), fluorine, and iodine as well as transition elements like vanadium, chromium, manganese (Mn), iron (Fe), cobalt, copper (Cu), zinc (Zn), and molybdenum. TEs belong within the micronutrient group, which is required at insignificant levels (often fewer than 100 mg/day), in contrast to sodium, calcium, magnesium, potassium, and chlorine, which are regarded to be macronutrients and required in greater proportions[2]. Major and TEs are crucial to maintaining human health. The presence or absence of certain components owing to natural or artificial causes might have serious medical effects. A teeth contains TE in its construction and is made up of both hard tissue (enamel, dentine, and cement) and soft tissue (pulp and periodontal ligaments). A teeth's multicellular nature allows it to work in harmony with the maxillofacial region[3].

THE EFFECT OF TRACT OF EIEMENTS ON THE TEETH

1. Zinc (Zn)

Zinc is an essential mineral that plays a role in oral health by supporting the formation of teeth enamel, the hard outer layer of the teeth that protects against decay[4]. Adequate zinc intake can help maintain the strength and integrity of teeth enamel, potentially reducing the risk of teeth decay and other oral health problems.

However, excessive zinc intake can have negative effects on oral health, including a reduction in the sense of taste and a discoloration of the teeth. It is important to maintain a balanced diet that includes a sufficient amount of zinc, as well as other nutrients important for oral health, to promote overall oral health and well-being[5].

2. Iron (Fe)

Iron is not known to have a direct effect on teeth. However, excessive consumption of iron supplements can lead to discoloration of teeth, due to the buildup of iron deposits on the surface of the teeth[6]. This discoloration is not harmful to the teeth or to oral health, but it can affect the appearance of the teeth. It is important to follow the recommended dosages of iron supplements and to maintain good oral hygiene practices, such as brushing and flossing regularly, to help minimize any potential impact on the teeth[7].

3. Magnesium (Mg)

Magnesium is essential for oral health and helps in the formation of strong and healthy teeth. It is involved in various processes related to teeth formation and maintenance, including the production of enamel and dentin, the formation of teeth structures, and the regulation of mineralization of the teeth surface. A deficiency of magnesium can lead to oral health problems such as teeth decay, gum disease, and teeth loss[4]. However, it's important to note that excessive magnesium intake can also lead to teeth problems, such as a change in the taste of food and a metallic taste in the mouth. To maintain healthy teeth and gums, it's recommended to consume a balanced diet that includes magnesium-rich foods, as well as other vitamins and minerals important for oral health[8].

4. Aluminum(Al)

Aluminum has no known direct effect on teeth[9]. However, consuming certain aluminum-containing antacids can lead to decreased saliva production, which can cause a decline in oral health and potentially lead to teeth decay and other oral health problems. It is also important to note that excessive intake of aluminum from antacids or other sources can have toxic effects on the body[10]. It is recommended to talk to a doctor or dentist about the use of aluminum-containing products and its potential impact on oral and overall health.

5. Potassium(K)

Potassium is an essential mineral that has several health benefits, including its impact on oral health[11]. Potassium helps to maintain the strength and mineral density of teeth, as it is involved in the formation and maintenance of teeth enamel. Additionally, potassium has been shown to reduce the risk of developing cavities and gum disease, which can lead to teeth loss[12]. However, excessive intake of potassium can have negative effects on oral health, as it may cause teeth discoloration and damage to the enamel. It is recommended to maintain a balanced and moderate intake of potassium as part of a healthy diet[13].

MATERIALS AND METHODS

First, teeth samples were collected from subjects aged (18-85) at the Teeth Specialist Center in Najaf, Iraq, and teeth samples from donors at the Specialized Teeth Center were collected and organized for analysis. Teeth specimen cards obtained and kept in hygienic conditions were given for XRF analysis. Forty healthy male and female teeth samples were taken and placed in special tubes with the addition of formalin compound in order to

preserve the biological characteristics of the sample, and stored at room temperature (22 degrees Celsius). After that, he took the sample, washed it with distilled water, and then dried it. Then, the sample was ground into a powder form using specialized mills or using a ceramic slurry, collected in sealed test tubes, weighed, and stored for 90 days to make it radioactive. The elemental concentrations Mg, Al, Fe, K and Zn were determined using X-ray spectroscopy.

STATISTICAL ANALYSIS

Using statistical software (SPSS for Windows version 20, SPSS Inc., Chicago, IL, USA), all results were calculated as the mean and standard with the lowest and highest value[14]. Mean error, Levine test, and P value can be considered as a statistical function if the value of ($p < 0.05$) while if ($P > 0.05$) is considered not statistically significant, all these results are tabulated in Table (3) [15].

RESULTS AND DISCUSSION

Forty dental samples were collected from healthy men and women with an average age of (18-85) years, then the content of the elements in the dental samples was measured using X-ray spectroscopy, where the concentration of the elements (Mg, Al, K, Fe and Zn) was determined through the table 2 We note that the concentration of magnesium and iron have higher values in dental samples compared to the elements aluminum, potassium and zinc.

Table (1): shows teeth samples from 40 people, men and women, with an average age (18-85) years.

sample	age(year)	gender	Smoker and non-smoker
T2	21	M	non-smoker
T5	29	M	non-smoker
T17	45	M	smoker
T29	25	m	non-smoker
T38	42	m	smoker
T44	44	f	non-smoker
T48	29	m	smoker
T62	42	f	non-smoker
T85	46	f	non-smoker
T86	60	m	smoker
T96	50	m	smoker
T98	43	f	non-smoker
T99	60	m	smoker

T111	42	m	smoker
T112	40	m	non-smoker
T115	39	m	smoker
T116	27	m	non-smoker
T117	28	m	non-smoker
T118	40	m	smoker
T119	19	f	non-smoker
T120	17	f	non-smoker
T123	70	f	smoker
T125	32	m	non-smoker
T126	53	f	non-smoker
T127	34	f	non-smoker
T128	35	m	smoker
T130	24	f	non-smoker
T131	45	f	non-smoker
T133	32	m	smoker
T137	45	f	non-smoker
T139	35	m	smoker
T140	45	f	non-smoker
T141	28	m	non-smoker
T142	34	m	Smoker
T146	34	f	non-smoker
T147	38	m	Smoker
T148	45	m	Smoker
T150	50	m	Smoker
T151	46	f	non-smoker
T152	52	f	Smoker

*m= male

*f= female

Table (2): The table represents the content of elements (Mg, Al, K, Fe and Zn) in teeth samples

sample	Elements content				
	Mg(%)	Al(%)	K(%)	Fe(%)	Zn(%)
T2	1.35	0.70	0.01	1.89	0.14
T5	1.39	0.26	0.03	1.27	0.09
T17	1.24	0.62	0.01	1.86	0.05
T29	1.54	1.04	0.00	1.93	0.04
T38	1.16	0.49	0.00	2.02	0.07
T44	1.25	0.42	0.03	1.74	0.05
T48	1.41	0.64	0.00	1.84	0.04
T62	1.40	0.19	0.00	1.86	0.10
T85	1.19	0.35	0.00	1.86	0.06
T86	1.32	0.29	0.00	1.92	0.47
T96	1.45	0.71	0.00	1.98	0.06
T98	1.62	0.42	0.00	1.94	0.09
T99	1.46	0.21	0.02	1.93	0.09
T111	1.06	0.00	0.00	1.73	0.05
T112	1.42	0.36	0.00	1.92	0.05
T115	1.62	0.76	0.00	1.96	0.13
T116	1.24	0.26	0.00	1.74	0.05
T117	1.54	0.57	0.01	1.97	0.08
T118	1.19	1.04	0.00	1.98	0.07
T119	1.36	0.52	0.00	1.77	0.05
T120	1.37	0.66	0.00	1.84	0.29
T123	1.46	0.67	0.06	1.80	0.04
T125	1.46	0.46	0.00	1.85	0.11
T126	1.18	0.52	0.00	2.02	0.06
T127	1.77	0.58	0.01	1.96	0.06

T128	1.34	0.28	0.05	1.90	0.11
T130	1.28	0.78	0.00	1.88	0.08
T131	1.38	0.58	0.05	1.94	0.05
T133	1.20	0.42	0.01	1.89	0.09
T137	1.40	0.37	0.00	1.79	0.35
T139	1.50	0.20	0.00	1.89	0.09
T140	1.46	0.39	0.01	1.96	0.09
T141	1.38	0.37	0.00	1.90	0.07
T142	1.54	0.37	0.06	1.88	0.10
T146	1.23	0.24	0.00	1.88	0.05
T147	1.21	0.44	0.00	1.84	0.63
T148	1.15	0.33	0.00	1.83	0.06
T150	1.72	0.10	0.05	1.89	0.11
T151	1.34	0.28	0.00	1.89	0.08
T152	1.31	0.71	0.07	1.96	0.06

Table (3): Represents the trace element content of teeth samples using the statistical program

Descriptive Statistics	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean ± SD	Std. Deviation Statistic
Mg	40	0.71	1.06	1.77	1.3723 ± 0.02512	0.15888
Al	40	1.04	0	1.04	0.465 ± 0.03649	0.23081
K	40	0.07	0	0.07	0.012 ± 0.00327	0.02066
Fe	40	0.75	1.27	2.02	1.8725 ± 0.01923	0.12165
Zn	40	0.59	0.04	0.63	0.1102 ± 0.01894	0.11982

Figure (1): shows the statistical mean of all values among trace elements in teeth samples of healthy people.

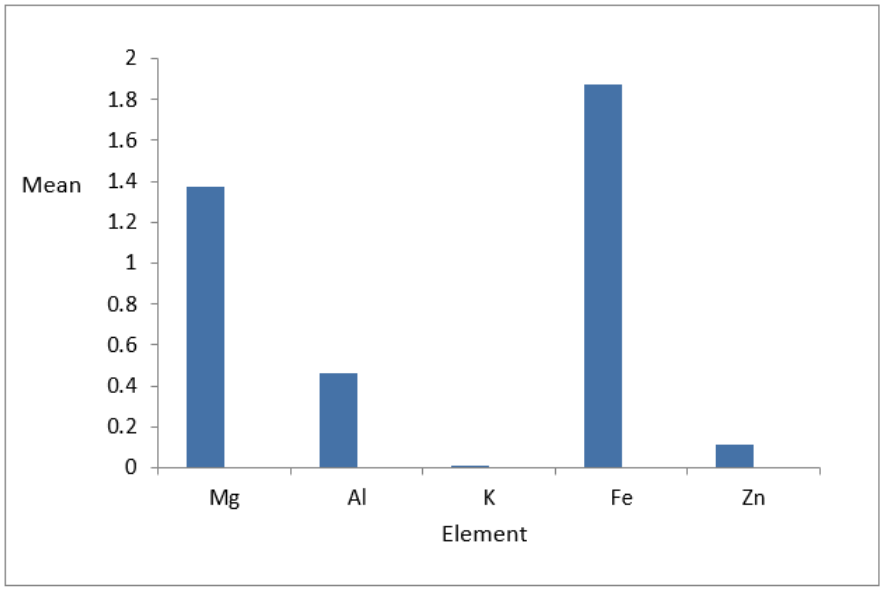

Table (4): The table shows the correlation coefficient with age, gender, smoking and effect elements(Mg, Al ,K ,Fe and Zn)

Correlations									
		Age	smoken	Gender	Mg	Al	K	Fe	Zn
Age	Pearson Correlation	1	-.412**	.b	-0.034	-0.201	.326*	0.217	0.052
	Sig. (2-tailed)		0.008	.	0.837	0.213	0.04	0.179	0.749
	N	40	40	0	40	40	40	40	40
smoken	Pearson Correlation	-.412**	1	.b	0.115	0.02	-0.281	-0.165	-0.143
	Sig. (2-tailed)	0.008		.	0.478	0.903	0.079	0.308	0.38
	N	40	40	0	40	40	40	40	40
Gender	Pearson Correlation	.b	.b	.b	.b	.b	.b	.b	.b
	Sig. (2-tailed)	.	.		.	.	.	.	.
	N	0	0	0	0	0	0	0	0

Mg	Pearson Correlation	-0.034	0.115	.b	1	0.1	0.227	0.152	-0.07
	Sig. (2-tailed)	0.837	0.478	.		0.541	0.159	0.35	0.669
	N	40	40	0	40	40	40	40	40
Al	Pearson Correlation	-0.201	0.02	.b	0.1	1	-0.031	.329*	-0.093
	Sig. (2-tailed)	0.213	0.903	.	0.541		0.851	0.038	0.567
	N	40	40	0	40	40	40	40	40
K	Pearson Correlation	.326*	-0.281	.b	0.227	-0.031	1	-0.103	-0.163
	Sig. (2-tailed)	0.04	0.079	.	0.159	0.851		0.527	0.315
	N	40	40	0	40	40	40	40	40
Fe	Pearson Correlation	0.217	-0.165	.b	0.152	.329*	-0.103	1	-0.039
	Sig. (2-tailed)	0.179	0.308	.	0.35	0.038	0.527		0.809
	N	40	40	0	40	40	40	40	40
Zn	Pearson Correlation	0.052	-0.143	.b	-0.07	-0.093	-0.163	-0.039	1
	Sig. (2-tailed)	0.749	0.38	.	0.669	0.567	0.315	0.809	
	N	40	40	0	40	40	40	40	40

**Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

b Cannot be computed because at least one of the variables is constant

Since the P-value is greater than 0.05, it is not statistically significant. Therefore, we did not find a statistical significance for the concentrations of magnesium, aluminum, potassium, iron and zinc in teeth samples of healthy people.

CONCLUSIONS

1- The current study sheds light on the role of trace metals in teeth samples.

2- Knowing and evaluating the concentration of mineral ions in the teeth.

3- Through Table 4, it was found that there is a correlation between a person's age and smoking, and there is a correlation between age and potassium concentration.

4 - There is a correlation between the content of Al and Fe concentrations in teeth samples.

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