Determination of Mineral Elements in Some Iraqi and Imported Wheat and Flour Samples by XRF

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Abstract. Food is the main source of supplying the body with the energy needed for vital human activities as well as for his health to reduce the incidence of chronic diseases and malnutrition diseases. Flour and wheat are considered important food items that people eat daily, especially for Iraqis, as no meal is devoid of bread or flatbread. Therefore, in this work, mineral concentrations were calculated and the daily intake of every 100 grams of minerals was estimated (minerals are one of the basic elements in nutrition). Seven flour samples collected, three local and four imported, in addition to three samples of local wheat. The results indicated that the major elements in these samples were Mg, Si, P, S, Cl, K, and calcium, and the minor elements were Al, Ti, Mn, Fe, Zn, Br, Sn, Ba, Ta, Te, Sr, and Cu. As for the trace elements, they were V, Cr, Co, Ni, Sb, Ga, Rb, Pb, Y, Mo, Ag, Cd, Cs, La, W, Nb, I, Ce, Zr, and Th. As for the ultra-trace elements, they were As, Se, Hf, Ge, Hg, Tl, Bi, and U. It was found that most of the concentrations could be less, close to, or more than the RDA values registered by some countries and international scientific organizations. For example, the concentration of Mg was as a maximum of 0.678 in sample 5, and as a minimum of 0.137 in sample 10. The daily intake can be estimated for every 100 grams according to what the person eats daily, at a rate of one to three loaves, i.e. between 125 and 375 grams. When compared with the RDA values of some countries such as the United States of America, Canada, India, European countries, and some scientific institutions such as the World Health Organization, the results for the concentrations of some elements may be more, less, or close to it. This depends on the human need according to their environment.
Key words: XRF, Nutrition, Minerals, Daily intake.

INTRODUCTION

The importance and impact of mineral elements on human health realized by ancient physicians, especially in Greece [1]. Minerals considered one of the important elements in nutrition, as there are main elements that are important in building the body, such as potassium, phosphorus, calcium, magnesium, and sodium [2]. There are also trace elements that are important for body functions, such as iron, zinc, copper, cobalt, iodine, molybdenum, vanadium, selenium, sulfur, chlorine, manganese, and strontium [2, 3, 4]. These minerals cannot be manufactured inside our bodies, so they can be obtained from their natural sources, which are water and soil, as plants obtain them first, then animals, and finally humans when they eat plants and meat [3, 4]. Our body needs 20 chemical elements to support biochemical processes. The most important of which is oxygen at 65%, followed by carbon and hydrogen at the same percentage of 18%, and nitrogen at 3%, to form a total of 96% [5]. To form the rest such as calcium 1.5%, phosphorus 1%, potassium, sodium, chlorine and magnesium 0.85% of body weight, and the rest of the minerals with low concentrations form 0.15% [3, 4]. The importance of minerals is evident in their many functions within the body, such as maintaining blood pressure as a result of fluid balance, in addition to acquiring immunity, transmitting nerve signals, muscle contraction, blood clotting, metabolism, growth and development [6].

A deficiency of nutrients or an imbalance in trace elements, for example, leads to high levels of cholesterol in the serum, such as chromium, iron, vanadium, copper and zinc [7]. X-ray fluorescence (XRF) is a cheap and non-destructive technique for determining major, minor and trace elements in different samples, including flour and rice [8]. Through this technique, the material bombarded with gamma ray photons or high-energy X-rays. As a result, the electron exits one of the inner shells, leaving a vacuum behind that immediately filled by electrons from other shells with higher energy. This results in X-ray fluorescence photons known as XRF, which are specific to each element in the material [9, 10, 11]. X-ray technique has been employ for the analysis of Iraqi vegetables [12].

The concept of (RDIs) developed in 1990 for the Nutrient Reference Intakes (NRIs) for vitamins and minerals. That was proposed and updated by the Institute of Medicine for the period from 1941 to 1989 by the United States of

America. Now known as the National Academy of Medicine [13, 14], in order for these values in both the United States of America and Canada serve as a guide to good nutrition first and to conduct the process of developing dietary guidelines second [13,15]. The term RDIs includes four categories. The first is the Estimated Average Requirement (EAR), and after adding 20% to it, we get the second, which is the Recommended Dietary Allowances (RDAs). The third category is the Adequate Intake (AI), which is based on the daily dietary intake of healthy people, and the fourth is the acceptable upper level of dietary intake (UL) without any harmful health effects on all individuals [13, 16].
In this work, the concentrations of minerals were calculated in flour and wheat samples collected from local markets, some of which were imported and others locally produced. The X-ray fluorescence (XRF) technique is used to calculate the concentrations of the minerals and then calculate the daily intake of these minerals per 100 grams. The calculation done in light of the daily intake of bread and loaves for the Iraqi person and at a rate of (1-3 loaves per day) and then the results are compared with the RDA of some countries such as the United States of America, Canada, India and Japan countries in order to establish the data related to nutrition [3,13,16,17].

EXPERIMENTAL PART

Collect the samples

Ten samples of wheat and flour were collected, seven of which were flour, some of which were imported, and the other locally produced, while the other three were locally produced wheat, as shown in Table 1.

TABLE 1. The collected samples with their symbols.

N0.	Sample	Sample type	Symbol
1	Iranian Flour (Das)	imported flour	Fim1 or S1
2	Erbil Flour	local flour	Flo1 or S2
3	Karbala Flour	local flour	Flo2 or S3
4	Baghdad Wheat	local wheat	Wlo1 or S4
5	Al-Mishkhab Wheat	local wheat	Wlo2 or S5
6	Turkish Flour (konoz)	imported flour	Fim2 or S6
7	Turkish Flour	imported flour	Fim3 or S7
8	Sulaimaniyh Flour	local flour	Flo3 or S8
9	Khan Bani-Saad Wheat	local wheat	Wlo3 or S9
10	Russian Flour	imported flour	Fim4 or S10

Preparing the samples

The samples prepared for measurement of each wheat variety after being milled, in addition to the flour, were taken as 3 g from each sample to be pressed in a press under a pressure of 5 tons to obtain tablets suitable for measurement in the X-ray fluorescence (XRF) machine.

The process of analysis and examination

The process of analysis and examinations carried out using an XRF instrument (Model Spectro Xepos), German-made. The collected samples were prepared as powder, then as a pellet (3 g) with a diameter of 30 mm and a thickness 5mm. This system produces a report that includes the percentages of all elements with the percentage of measurement error and their detection limit, which is calculated for the elements alone or with their oxides. The latter has been use in our calculation.

RESULTS AND DISCUSSIONS

Table No. 2 shows the major elements that are detected by the XRF technique. The list included Magnesium, Silicon, Phosphorus, Sulfur, Chlorine, Potassium, and Calcium, whose concentrations in grams per gram. We find that the highest concentration of Magnesium was (0.678) in sample S5, which is Al-Mishkhab wheat, and the lowest concentration was (0.1376) in sample S10, which is Russian flour. As for the Phosphorus element, its highest concentration was (1.6713) in sample S6, Turkish flour (Konoz), while the lowest concentration was (0.513) in sample

S10, Russian flour. If we also look at the potassium concentration, it was the highest (1.904) in sample S5, Al-Mishkhab wheat, and the lowest concentration was (0.107) in sample S8, Sulaimaniyh flour. As for calcium, it was the highest concentration was (1.372) in sample S9, Khan Bani Saad wheat, and the highest concentration of (0.103) was in sample S10, Russian flour. Accordingly, when looking at the list of the elements, we find that sample S10 recorded the lowest concentrations for most of the major elements, while sample S5 recorded high concentrations for most of the elements. This indicates that national production is better than imported production. Which contains reasonable concentrations of minerals, and this depends on the nature of the land, which can be monitored and the national production monitored.

TABLE 2. Major element concentration in Flour samples (%)

	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**
Mg	0.451±0.014	0.1401±0.0040	0.294±0.0150	0.5±0.0079	0.678±0.0900	0.254±0.0180	0.1518±0.0041	0.417±0.0420	0.3732±0.0080	0.1376±0.0011
Si	0.017±0.0050	0.194±0.0013	0.278±0.0027	0.9433±0.0026	1.505±0.0230	0.004±0.0050	<11±0.0	0.072±0.0190	2.231±0.0040	0.00075±0.0013
P	0.9376±0.0016	0.5674±0.0011	1.373±0.0020	1.179±0.0020	1.50069±0.0	1.6713±0.0018	0.5665±0.001	0.70069±0.0	1.035±0.0010	0.513±0.0011
S	0.208±0.0010	0.4869±0.0007	1.302±0.0010	0.6028±0.0008	0.785±0.0110	0.92±0.0030	0.4844±0.0007	0.7027±0.0058	0.4805±0.0007	0.4639±0.0007
Cl	0.0433±0.0005	0.08692±0.00013	0.0435±0.0006	0.1403±0.0002	0.6±0.0200	0.378±0.0010	0.08427±0.00013	0.09±0.0100	0.1033±0.0001	0.09808±0.00014
K	0.573±0.0050	0.2698±0.0014	0.221±0.0070	1.351±0.0030	1.904±0.0180	0.54±0.0060	0.2752±0.0014	0.107±0.0150	0.8625±0.0024	0.2734±0.0015
Ca	0.657±0.0040	0.1355±0.0008	1.024±0.0040	0.6887±0.0020	0.805±0.0120	0.9711±0.0033	0.1205±0.0008	0.57±0.0400	1.372±0.0030	0.103±0.0007

Table No. 3 also shows the minor elements concentrations that calculated in µg/gram or ppm. Which concluded Al, Ti, Mn, Fe, Zn, Br, Sn, Sb, Ba, Ta, and Te. Some of these elements are important for biochemical processes. The highest concentration of iron (Fe) was (2494) ppm in the sample S9 (Khan Bani-Saad), and the lowest concentration was less than (1.4) in sample S10 (Russian flour). As well as the highest concentration of aluminum (Al) was (480) ppm in sample S9 (Khan Bani Saad), and the lowest concentration less than (3.8) ppm in sample S10 (Russian flour). While we find the highest concentration of Manganese (Mn) was (730) ppm in sample S8 (Sulaimaniyh flour), and the lowest concentration was (6.4) ppm in sample S5 (Al-Mashkhab wheat).

TABLE 3. Minor element concentration in Flour samples (µg/g) 1000> C >10

	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**
Al	9.1±36	<38±0.0	<38±0.0	873±20	38±0.0	<38±0.0	<38±0.0	20±1.9	4080±34	<3.8±0.0
Ti	252.6±8.6	<3.4±0.0	74.8±7.5	117.9±7.7	72±0.0	109.7±7.2	<3.4±0.0	6.0±3.9	361.3±9.3	<3.4±0.0
Mn	219.2±2.2	13.0±1.1	67.8±1.5	167±2.0	6.4±1.0	187.9±2.1	13.4±1.1	730±6.9	134±1.9	9.0±1.1
Fe	8.7±5.0	23.3±0.3	69±0.0	798.3±3.0	159.2±0.2	80.8±3.1	1.4±0.1	70±4.0	2494±6.0	<1.4±0.0
Zn	157.3±0.7	12.7±0.2	100±0.1	86.3±0.5	7.2±0.3	50.4±0.4	15.5±0.3	80.8±0.9	75±0.5	9.9±0.2
Br	38.5±0.2	7.0±0.1	17.4±0.1	2.8±0.1	45.7±0.2	35.8±0.2	4.9±0.1	114.9±0.5	3.5±0.1	15.4±0.1
Ba	31.6±3.6	110.42±5.2	59.73±4.9	41.42±4.4	<2.23±0.0	20.21±2.8	29.03±4.0	213.14±8.6	44.88±4.5	<2.35±0.0
Ta	54.8±1.6	56.4±0.9	50.4±1.0	67.7±1.0	52.9±0.8	55.8±1.0	55.4±0.9	95.0±2.4	67.5±0.9	56.2±0.9
Te	<3.0±0.0	34.3±1.0	10.1±0.7	4.8±0.5	<3±0.9	0.7±0.1	4.5±0.5	<3±0.0	5.4±0.5	4.0±0.5

The highest concentration of Zinc (Zn) was 157.3 ppm in sample S1 (Iranian flour), and the lowest concentration was 7.2 ppm in sample S5 (Al-Mashkhab wheat). In general, we find in this table that most of the high concentrations are found in sample S9(Khan Bani-Saad wheat). Most of the lower minor element concentrations were in sample S10

(Russian flour). Once again, we note that national production was rich with minerals, and this depends on the soil, while we find that imported flour contains lower concentrations of minerals than national production, and can be monitored locally.

TABLE 4. Trace elements concentration in Flour samples (μg/g) or (ppm)

Sample	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
V	<14±1.3	<4.1±0.4	<10±1.0	<10±0.1	<52±7.6	<18±1.7	<11±1.1	157±1.8	<10±1.0	<15±1.5
Cr	4.2±0.3	<1.5±0.0	24.5±1.1	<2.4±1.5	<1.5±0.0	9.3±0.6	<1.5±0.0	215.3±5.0	18.5±1.0	<1.5±0.0
Co	<3.9±0.0	<3.9±0.0	<3.9±0.0	<3.9±0.0	<3.9±0.0	<3.9±0.0	<3.9±0.0	<10±0.0	<3.9±0.0	<3.9±0.0
Ni	58±0.6	6.4±0.3	9.7±0.3	10.8±0.3	6.5±0.3	14.4±0.3	7.2±0.3	175.7±1.7	15.2±0.4	6.6±0.3
Sb	6.0±0.8	37.7±1.3	12.2±1.1	9.9±0.0	11.8±1.2	5.6±0.7	9.7±1.1	<4.0±0.0	11.3±1.1	9.9±1.1
Ga	1.47±0.2	1.87±0.8	0.67±0.2	<0.67±0.0	2.8±0.2	1.2±0.2	2.0±0.3	13.61±0.5	<0.67±0.0	1.87±0.2
Rb	4.0±0.1	1.5±0.1	6.1±0.1	3.1±0.1	1.1±0.1	2.1±0.1	1.6±0.1	46.1±0.3	4.2±0.1	1.0±0.1
Pb	3.1±0.2	0.8±0.0	0.9±0.2	1.9±0.2	2.5±0.1	2.1±0.2	0.8±0.2	12.2±0.5	1.2±0.2	1.1±0.2
Y	2.41±0.1	4.57±0.1	1.19±0.1	4.06±0.1	<0.635±0.1	3.05±0.1	4.32±0.0	17.52±0.3	3.81±0.1	4.95±0.1
Mo	4.1±0.2	3.2±0.2	0.9±0.2	1.7±0.2	9.4±0.2	4.1±0.2	2.6±0.2	15.4±0.7	2.3±0.2	2.9±0.2
Ag	4.4±0.7	18.3±0.6	<2.0±0.0	3.1±0.7	<2.0±0.6	3.2±0.6	<2.0±0.0	<2.0±0.0	5.2±0.7	3.9±0.7
Cd	1.6±0.3	11.5±0.4	2.6±0.4	0.4±0.1	<2.0±0.6	0.8±0.2	1.2±0.3	<2.0±0.0	1.8±0.3	1.3±0.3
Cs	<4.0±0.0	<4.0±0.0	<4.0±0.0	<4.0±0.0	<4.0±0.8	<4.0±0.0	<4.0±0.0	<4.0±0.0	<4.0±0.0	<4.0±0.0
La	<2.35±0.0	<2.35±0.52	<2.35±0.0	<2.35±0.0	<2.35±0.0	<2.35±0.0	62.28±0.6.3	<2.35±0.0	<2.35±0.0	<2.35±0.0
W	<1.3±0.0	0.7±0.2	1.3±0.0	81.2±0.8	2.9±0.0	<0.6±0.3	<1.3±0.0	<0.6±0.0	<1.3±0.9	<1.3±0.0
Nb	<1.4±0.0	0.7±0.0	<1.4±0.0	1.3±0.2	<1.4±0.0	<1.4±0.0	<1.4±0.0	10.2±0.7	<0.3±0.3	<1.4±0.0
I	<3.0±0.0	16.8±0.8	11.3±1.0	5.4±0.8	14.2±0.8	<3.0±0.0	6.2±0.8	3.9±1.2	6.8±0.8	4.4±0.8
Ce	<2.46±0.0	<2.46±0.0	<2.46±0.0	41.64±4.3	<2.46±0.0	<2.46	<2.46±0.0	<2.46±0.0	<2.46±0.0	<2.46±0.0
Zr	2.0±0.5	<1.4±0.0	<1.4±0.0	<1.4±0.0	<1.4±0.0	<1.4±0.0	<1.4±0.0	120.9±2.8	75±0.3	9.9±0.0
Th	1.48±0.1	1.02±0.1	0.57±0.1	1.48±0.1	3.53±0.1	2.28±0.1	1.93±0.1	5.46±0.3	1.25±0.0	1.93±0.1
Sn	1.0±0.2	34±1.0	5.7±0.6	<3.9±0.0	7.0±0.9	<3.9±0.0	<3.9±0.0	6.1±0.7	8.0±0.7	6.9±0.7
Sr	93.9±0.2	2.7±0.1	88.8±0.2	29±0.1	34.2±0.1	44.4±0.2	2.7±0.1	845.9±1.1	30.9±0.1	4.3±0.1
Cu	109.7±0.7	8.9±0.4	25.5±0.5	14.1±0.5	1.3±0.4	14.9±0.5	8.9±0.4	35.9±1.1	8.9±0.5	9.1±0.4

Table 4 shows the trace element concentrations (less than 10 ppm), the most important of these elements were Cr, V, Co, Mo, and I. In addition to some heavy toxic elements such as Ni, Pb, W, Cd, and Th, whose concentrations were less than 10 ppm in most of the flour and wheat samples, except for the sample S8 (Sulaymaniyah flour). The concentrations of most elements were higher than for the other samples, and some of them exceeded the acceptable concentrations. This depends on the nature of the land in which the wheat is grown, and then the flour obtained after grinding the wheat locally.

As for the ultra-trace elements that are shown in table (5), the concentrations of this group, which included As, Se, Hf, Hg, Ge, Tl, Bi, and U, indicated that the concentration values were less than 1 ppm.

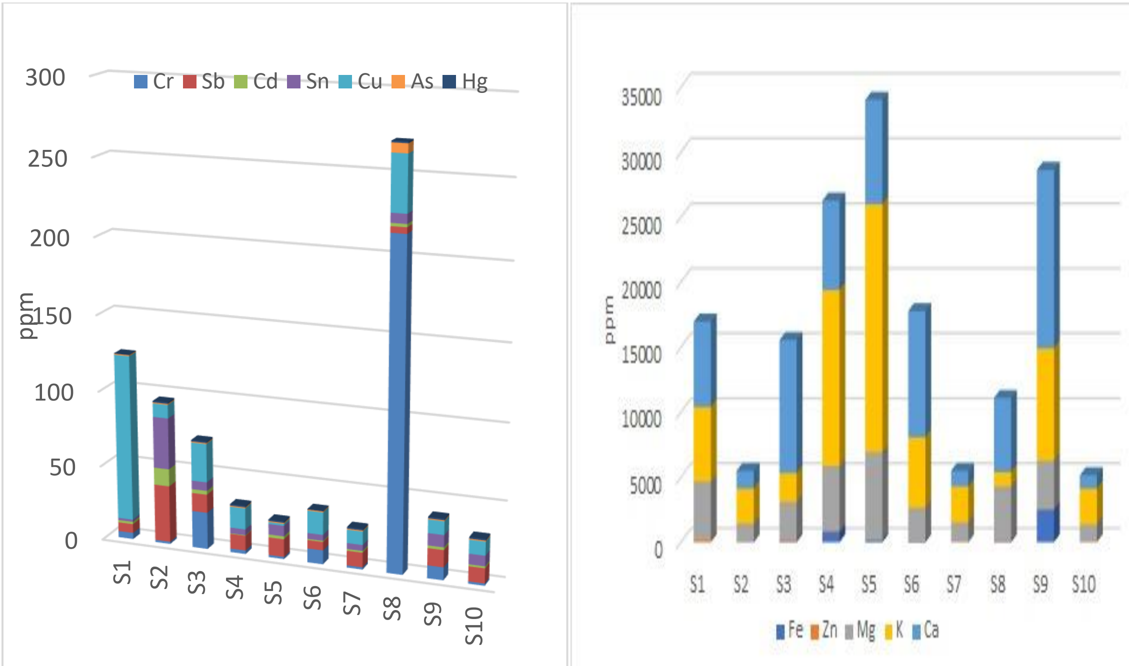
TABLE 5. Ultra-Trace elements concentration in Flour samples (µg/g) or (ppm)

Sample	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
As	<0.7±0.0	<0.7±0.0	<0.7±0.0	<0.7±0.0	<0.7±0.0	<0.7±0.0	<0.7±0.0	6.0±0.4	<0.7±0.0	<0.7±0.0
Se	<0.5±0.0	<0.5±0.0	<0.5±0.0	<0.5±0.0	<0.1±0.0	<0.5±0.0	<0.5±0.0	<0.5±0.0	0.3±0.1	<0.5±0.0
Hf	<0.7±0.0	<1.0±0.0	<1.0±0.0	<1.0±0.0	<1.0±0.0	0.6±0.1	<1.0±0.0	<1.0±0.0	0.6±0.2	<1.0±0.0
Ge	<0.5±0.0	<0.5±0.0	<0.5±0.0	<0.5±0.0	<0.4±0.1	<0.5±0.0	<0.5±0.0	<0.5±0.0	<0.5±0.0	<0.5±0.0
Hg	0.3±0.1	<1.0±0.0	<1.0±0.0	<1.0±0.0	<1.0±0.0	0.4±0.1	<1.0±0.0	<1.0±0.0	<1.0±0.0	<1.0±0.0
Tl	0.4±0.1	<1.0±0.0	<1.0±0.0	0.2±0.0	1.2±0.1	0.9±0.1	<1.0±0.0	0.4±0.2	<1.0±0.0	<1.0±0.0
Bi	<1.0±0.0	<1.0±0.0	<1.0±0.0	<1.0±0.0	<1.0±0.0	<1.0±0.0	<1.0±0.0	<1.0±0.0	<1.0±0.0	<1.0±0.0
U	1.65±0.1	1.18±0.1	0.80±0.1	0.94±0.1	<0.47±0.1	1.89±0.1	1.06±0.1	2.948±0.2	0.35±0.1	1.30±0.1

There are five major categories of mineral deficiencies: calcium, iron, magnesium, potassium, and zinc. Figure-1(a) shows the concentrations of these minerals in collected samples. The highest Calcium concentration was 13720ppm in sample S8. Calcium is essential for building strong bones and teeth and supports the function of blood vessels, muscles, nerves, and hormones. Calcium deficiency leads to osteoporosis [18]. The highest Iron concentration was 2494ppm in sample S9. Iron is part of proteins and enzymes that maintain a healthy body. Slow iron deficiency causes anemia [18]. The highest Magnesium concentration was 6780ppm in sample S5. Magnesium needed by our bodies for hundreds of chemical reactions that control blood glucose levels and blood pressure, the proper function of muscles, nerves, and brain function, energy metabolism, and protein production. Magnesium deficiency can lead to numbness and tingling, muscle cramps, seizures, and irregular heartbeats [19]. The highest Potassium concentration was 19040ppm in sample S5. Potassium is essential for muscle contraction, proper heart function, and the transmission of nerve signals. It is also required by certain enzymes, particularly the enzyme that helps the body convert carbohydrates into energy. Severe potassium deficiency can lead to muscle paralysis or an irregular heartbeat, which can lead to death [19]. The highest Zinc concentration was 100ppm in sample S3. Zinc plays an important role in metabolism, such as protein synthesis, immune system function, wound healing, and DNA synthesis. It is essential for proper growth and development during pregnancy, childhood, and adolescence. Zinc deficiency can cause loss of appetite, taste, or smell, as well as decreased immune system function and slowed growth [20].

In addition to some heavy toxic elements such as As, Cr, Sb, Cd, Sn, Cu, and Hg concentrations were less than 10 ppm as shown in figure-1(b). As for the arsenic element, its highest concentration was 6 ppm in **S8** (Sulaymaniyah Flour). This concentration is less than the highest value set by the USA Food and Drug Administration (100 µg/g or ppm) in 2023, while the European Union set the value (200 µg/g). Arsenic causes cancer and damage to various organs [18]. The highest Cadmium concentration was 11.5 ppm in S2 accumulates in the kidneys and bones. Highest Chromium concentration was 215.3 ppm in S8, which is linked to cancer. The highest Lead concentration was 12.2 ppm in S8, which affects the nerves, heart, and blood vessels. For Mercury concentration was 0.4 ppm in S6, which affects the nervous system and brain. But the highest copper concentration was 109.7 ppm in S1, excess amount cause neurological problems or liver damage. From table-4 the highest tin concentration was 34 ppm in S2, and the large amounts of inorganic tin, according to research studies, causes stomach pain, anemia, and liver and kidney problems. At last Antimony concentration 37.7 ppm in S2, its accumulation causes dermatitis, rhinitis, and inflammation of the upper and lower respiratory tract.

References 19 and 20 published the latest data on the effects of accumulation or deficiency of these elements on the human body, which represent Appendix for this subject. These metals pose a threat to human health due to their accumulation in the body due to environmental pollution, exposure in the workplace, or through contaminated food. The daily intake values were calculated and placed in tables (6, 7, and 8), which indicated values of more, less, or close to what is published worldwide and has been prove by these tables. When noting the report on the recommendation for daily intake of more than 40 nutritional items depending on age, gender and life stages, Harvard University [13] contributed to it, as shown in the daily intake table (9) for different countries to compare with that that were calculated in this work.



(a) (b)

FIGURE 1. (a) **C**oncentrations of some five major elements. (b) **C**oncentrations of some heavy and toxic elements.

TABLE 6. Major elements daily intake per 100 g

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Mg	15.033	4.670	9.799	16.666	22.600	8.4666	5.0599	13.90	12.440	4.587
Si	0.5667	6.467	9.266	31.443	50.166	0.133	<0.037	2.40	74.366	0.025
P	31.253	18.913	45.762	39.30	50.023	55.709	18.883	23.356	34.50	17.10
S	6.9333	16.230	43.396	20.093	26.166	30.666	16.147	23.423	16.017	15.463
Cl	1.443	2.897	1.450	4.677	20.00	12.60	2.809	3.00	3.443	3.269
K	19.10	8.993	7.366	45.033	63.466	18.00	9.173	3.567	28.750	9.113
Ca	21.90	4.5166	34.130	22.956	26.833	32.370	4.0166	19.0	45.733	3.4333

TABLE 7. Minor elements daily intake per 100 g

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Al	3.030	<12.654	<12.654	290.709	12.654	<12.654	<12.654	6.66	1358.64	<12.654
Ti	84.116	<1.132	24.908	39.261	23.976	36.530	<1.132	1.998	120.313	<1.132
Mn	72.994	4.329	22.577	55.611	2.131	62.571	4.462	243.09	44.622	2.997
Fe	2.897	7.759	22.977	265.834	53.014	26.906	0.466	23.31	830.502	<0.466
Zn	52.381	4.229	33.3	28.738	2.398	16.783	5.162	26.906	24.975	3.297
Br	12.821	2.331	5.794	0.932	15.218	11.921	1.632	38.262	1.166	5.128
Ba	10.523	36.770	19.890	13.793	<0.743	6.73	9.667	70.976	14.945	<0.783
Ta	18.248	18.781	16.783	22.544	17.616	18.581	18.448	31.635	22.478	18.715
Te	<1.0	11.422	3.363	1.598	<0.999	0.233	1.499	<0.999	1.798	1.332
Sr	31.269	0.899	29.570	9.657	11.389	14.785	0.899	284.648	10.29	1.432
Cu	36.530	2.964	8.492	4.695	0.433	4.962	2.964	11.955	2.964	3.030

TABLE 8. The Trace elements daily intake (ppm) per100g

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
V	<4.662	<1.365	<3.33	<3.33	<17.316	<5.994	<3.663	52.281	6.993	<4.995
Cr	1.399	<0.50	8.159	<0.799	<0.50	3.097	<0.50	71.695	2.831	<0.50
Co	<1.299	<1.299	<1.299	<1.299	<1.299	<1.299	<1.299	<3.33	<1.299	<1.299
Ni	19.314	2.131	3.230	3.596	2.165	4.795	2.398	58.508	5.062	2.198
Sb	1.998	12.554	4.063	3.297	3.929	1.865	3.2301	<1.332	3.763	3.297
Ga	0.49	0.623	0.223	<0.223	0.932	0.4	0.666	4.532	<0.223	0.623
Rb	1.332	0.5	2.031	1.032	0.366	0.699	0.533	15.351	1.399	0.333
Pb	1.032	0.266	0.3	0.633	0.833	0.699	0.266	4.063	0.4	0.366
Y	0.803	1.522	0.396	1.352	<0.211	1.016	1.439	5.834	1.269	1.648
Mo	1.3653	1.0656	0.2997	0.5661	3.1302	1.3653	0.8658	5.1282	0.7659	0.9657
Ag	1.4652	6.0939	<0.666	1.0323	<0.666	1.0656	<0.666	<0.666	1.7316	1.2987
Cd	0.5328	3.8295	0.8658	0.1332	<0.666	0.2664	0.3996	<0.666	0.5994	0.4329
Cs	<1.332	<1.332	<1.332	<1.332	<1.332	<1.332	<1.332	<1.332	<1.332	<1.332
La	<0.783	<0.783	<0.783	<0.783	<0.783	<0.783	20.739	<0.783	<0.783	<0.783
W	<0.433	0.2331	0.4329	27.04	0.9657	<0.20	<0.433	<0.20	<0.433	<0.433
Nb	<0.466	0.2331	<0.466	0.4329	<0.466	<0.466	<0.466	3.3966	<0.1	<0.466
I	<1.0	5.5944	3.7629	1.7982	4.7286	<1.0	2.0646	1.2987	2.2644	1.4652
Ce	<0.819	<0.819	<0.819	13.866	<0.819	<0.819	<0.819	<0.819	<0.819	<0.819
Zr	0.666	<0.466	<0.466	<0.466	<0.466	<0.466	<0.466	40.26	24.975	3.2967
Th	0.493	0.34	0.19	0.493	1.175	0.759	0.643	1.818	0.416	0.643
Sn	0.333	11.322	1.8981	<1.299	2.331	<1.299	<1.299	2.031	2.664	2.298

TABLE 9. The daily intake per 100 g for some minerals in different countries

	India [17]	U.S.A [13]	Japan [3]	FAO, WHO [20]	Canada [21]
Mg	340mg	350mg	350mg	-----	350 mg
Cr	50 µg	N*	1.0mg	-----	N*
Cu	1.7mg	10mg	10mg	-----	10 mg
Cl	1800-2300 mg	N*	---	-----	N*
I	150 µg	1100	130 µg	-----	1100mg
Mo	45 µg	11mg	30 µg	-----	2000mg
P	600mg	4000mg	1000mg	-----	4000mg
K	3750mg	N*	2500mg	-----	3400mg
Ca	600mg	2500mg	650mg	500-800mg	2500mg
Fe	17mg	45mg	7.5mg	7-40mg	45mg
Zn	12mg	40mg	10mg	12-20mg	40mg
Se	---	400 µg	30 µg	-----	400 µg
Mn	---	11mg	4.0mg	-----	11mg

N* There is not enough research, so the recommended dose has not been determined despite its nutritional importance.

CONCLUSIONS

XRF technology can be relied upon to determine the concentrations of minerals, especially those with low mass numbers. The daily intake calculations for most samples have indicated intake values that are higher than the highest values recorded by Harvard University in the United States and Canada, especially for the element's calcium, magnesium and phosphorus. This may have a negative impact because the daily intake of these elements is high, especially if the usual daily intake for an Iraqi person is calculated to be between 125 to 375 grams of bread per day. The data obtained from this work may correct many misconceptions about bread intake and the nutritional values obtained from it. In addition, this data can be used by food companies in production with specific specifications. It is also possible to rely on such research to create or make a recommendation for daily intake in our region, which lacks such data. This situation like that of developed countries, which different cultural food patterns. It can be concluded that a deficiency or excess of minerals in a person's intake leads to health problems, and healthcare can play a significant and effective role in avoiding this.

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