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MINERAL PROCESSING IMPACT ON WHEAT AND BARLEY (TIRY BREAD AND SAMOON AS AN EXAMPLE)

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ABSTRACT

Bread (Tiry and Samoon), a special and vital bread in a Kurdistan region- Iraq, which people consume daily in their meals. Tiry bread and Samoon contain some macro and micro minerals. Also, consumption of bread is the course of enter the heavy metals into food chain. In this study, wheat and barley flour is used to produce the Tiry bread and Samoon, and some macro and micro minerals in both (wheat and barley) flour and breads that produces them are indicated. In addition, the effect of minerals in bread and Samoon are displayed on human health in a long period. A total of 16 minerals were indicated from breads and flour by Inductive Coupled Plasma (ICP). The highest concentration of Fe, CD, Mn Zn, Cu, and Cr were obtained from barley Turkish flour (28.967, 0.035, 30.723, 20.445, 4.989 and 1.206 mg/kg). Furthermore, the highest V, Mo, B, Ba, and Sb were obtained from TBF (1.713, 1.01, 1.48, 4.038, 0.408 mg/kg). The results of the study showed that the concentration of (Fe, Cd, Mn, Zn, Pb, Se, Ni, Ci, Cr, V, Mo, B, Mg, Ba, Sb and As) in a limited range providing by FAO/WHO. Also, the daily intake and PTWi in some of them are high. but not higher than the range of limitation.

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INTRODUCTION

Healthy food is a core problem in the world because people's demand for food is gradually increasing. In addition, in agriculture sector, cereal crop is recorded as the first rank to cultivate and respond to people's demand for food globally (Tejera *et al*., 2013). However, wheat is the first cereal crop to production around the world (Me-Nsope & Larkins, 2016). The leading countries for wheat production are India, China, European Union, and USA. Wheat sowing area is approximately (225 million hectares) worldwide (Singh *et al*., 2011; Me-Nsope & Larkins, 2016). However, the cultivation area to cultivate wheat in Iraq is ranged (1 to 2.5 million hectares) approximately (70 %) of total cereal crops. Also, barley production in Iraq around (20 %) of total cereal crops (UN Food and Agriculture Organization, 2014) .

Indeed, wheat and barley contained vital minerals, vitamins, and some chemical compounds (Ibrahim, *et al*., 2020). Also, lots of study about bakery products and the quality of bakery products from the wheat and barley have been found, which enhance the taste, quality, and function of food (Al-Saleh & Brennan, 2012). In addition, the flour coming from the wheat and barley is a source of bread, which is staple food in developing countries (Pirhadi, Shariatifar, Bahmani, & Manouchehri,

2022). Moreover, wheat and barley are an essential and staple food for human diet in Iraq, especially North-area (Kurdistan-region) (Rasheed, 2021) .

Despite, various studies investigated the heavy metal contamination of food stuffs due to agricultural practices such as applying lots of pesticides, fertilizer, irrigation, harvesting process, and transportation (Brhane & Dargo, 1394), (Sankhla *et al*., 2016). Besides, heavy metals in bread are indicated among most food contaminants, which is a considerably environmental problem and excess amount of ratio of heavy metals in bread directly affects human health (Al-Kamil, 2011). Likewise, lots of studies have investigated some of the minerals from food and bread like (Selenium (Se), Arsenic (As), Chromium (Cr), Nickel (Ni) and Cadmium (Cd)), which whose consumption and accumulation in human body excessively cause diseases (Organization, 1996; Sankhla *et al*., 2016) .

In other respects, minerals in bread have important roles for human health because breads contained lots of essential micro and macro elements that are crucial to human health such as Iron (Fe), Zink (Zn), Manganese (Mn), and Copper (Cu). Moreover, some other macro elements, like Magnesium (Mg), Molybdenum (Mo), and Barium (Ba) (Rasheed, 2021; Zakhama-Sraieb *et al*., 2016), and (Nadir, *et al*., 2020). Otherwise, heavy metals in food become toxicity-surrounding food chain due to its accumulation in the human body and not biodegrading (Xiong, Zhao, & Li, 2006; Antoniadis *et al*., 2017; Chen, Huang, & Liu, 2009) .

Pirhadi *et al*., (2022) clarified that the effect of some heavy metals on the human health; for example, Arsenic is used for some drags, soaps, and paints, whereas Arsenic has some side effects to the human health such us, vomiting, cancer, and other skin and blood diseases. Also, Lead, Cadmium, Nickel, Selenium, Barium, and Silver are applied in some industrial stuffs like batteries, coating, gasoline, knives, fork, jewelry, electronic equipment, and pipe solder. However, Cadmium and Lead cause some problem to human health (Rizwan *et al*., 2016; Rasheed, 2021; Pirhadi *et al*., 2022). In addition, Chromium, Cobalt, and Aluminum in foods (bread) have an important role in human health because they help to the human immune system (Organization, 1996; David, *et al*., 2008; Tejera *et al*., 2013; Sankhla *et al*., 2016; Rizwan *et al*., 2016).

Indeed, wheat and barley bread are a traditional food consumed in diet from the developed country (Ciudad-Mulero *et al*., 2021). Moreover, in North of Iraq (Kurdistan-region), different kinds of bread and Samoon can be found, they are produced from wheat and barley flour. In addition, residents in Iraq consume Samoon in their daily meals. However, in my previous study, I worked on wheat and barley flour to produce Tiry bread in a baking process and I indicated the physiochemical properties of the bread product. In this study, the main objectives are to indicated some micro and macro minerals from (flour and bread) and to rate of toxicity in the bread products (Tiry and Samoon), which are produced and prepared in the laboratory with our team.

MATERIALS AND METHODS

Tiry and Samoon are two types of bread, that people in Iraq and Kurdistan-region consume in their daily meals. In addition, the bakery processes of Tiry and Samoon are clarified in subchapters to show the differences with other bakery processes. However, this study was applied in Halabja Technical College of Apply

Sciences, Sulimani Polytechnic University, in (2022), a part of study was carried out from Kurdistan Institution for Strategic Studies and Scientific Research. Also, because it is important and directly relate to the people diet, we select to test these breads and indicate some of their mineral components.

Flour Sampling

Three types of flour are used in this experiment: The Turkish wheat flour (TWF), Kurdish barley flour (KBF) and Turkish barley flour (TBF), they were taken from the local markets which were applied to produce the Tiry bread and Samoon bread in a traditional way of bakery. Before producing the Tiry and Samoon, the flour samples were brought to laboratory in the Kurdistan Institution for Strategic Studies and Scientific Research to the indicate mineral ratios. After the bakery were taken place, the samples were brought to test the same minerals to indicate the differences in ratios.

Tiry Bread Preparation

The traditional way was used for baking the Tiry bread. In this study, two types of Tiry bread were prepared; first one consists of 100 % of wheat flour, 1.8 % of salts and the water, the second type of Tiry bread contains 50 % of Turkish barley flour, 50 % of Kurdish barley flour, water and 1.8 % of salt. The amount of water was gradually added until the dough looked like good for this type of bread. Then, the dough preparation and process of kneading were using hand. Moreover, the dough of the Tiry bread did not need the fermentation. After that, the dough was ready to directly produce balls (Goonk). The dough was cut into small pieces approximately (200 g). Then, the bread was formed stick with (40 cm) in diameter, and applied fine flour during the formation process. After that, the bread is put on a heated (Saj) around (210 ± 5 0C) for a few minutes around (2 – 2.30) minutes.

Samoon Preparation

Samoon was prepared in a food-processing laboratory. From the barley flour and wheat flour, two typed of Samoon were prepared; one of them consists of 100 % of wheat flour, and the other one consists of (50 % of wheat flour + 50 % of barley flour). (1.5 kg) of wheat flour were used to bake Samoon, and (0.75 kg) of barley flour were used to bake Samoon, then, it was mixed with (0.75 kg) of wheat flour. Thus, for each type of Samoon, (20 g) of yeast and (10 g) of salt were added, then, the ingredients were mixed, finally, enough cold water was added to the flour. In addition, the mixing Process and dough were made by hand which the dough needs to distribute the various ingredients and allowing the flour gluten to give the best baking possibility. After that, the mixture was left for (30 minutes) to ferment in order to increase the dough size. Then, the dough was remixed and balls weighting (100 g) were made. Later, the balls were put in a warm place for (20 minutes). And baked for (20 minutes) in a preheated oven at (230 0C) for (18 to 20 minutes).

Analysis of Minerals

Approximately, (10 g) of wheat and barley flour were weighted before using to produce the Tiry and Samoon bread to indicate some mineral content in to the flour. After the bakery, we took the (10 g) of bread that own produced from the flour. Then, the samples were dried to remove the moisture content. and nearly (2 ml) of (68% HNO_3) was added to them. Next, the samples were in to the muffle France for (48 hours) at 500 ± 5 oC). Then, approximately (0.2 ml) of (68% HNO_3) was added

to the ashes to remove the organic matter and remove the nitric, using hot plate to evaporation them. After that, the ash was filtered and (1.5 % of HNO3) were added to dissolve and up to a volume of (25 ml) (Koubová, Sumczynski, Šenkárová, Orsavová, & Fišera, 2018). The minerals were indicated from the sample by ICP- MS (thermos-fisher Scientific ICAP Q, Germany), following the procedure was cited by (González-Weller, *et al*., 2010).

Daily Intake of Minerals Through Bread Consumption

The daily intake of minerals in the bread through bread consumption were calculated according to the following equation that cited by (Naghipour, *et al*., 2014; Rasheed, 2021).

$$DI_M = \frac{C * DI_{Bread}}{B.W} \qquad (1)$$

Whereas DIM is daily intake of minerals (µg / Kg per day). And, C is metals concentration in bread (mg / Kg). Then, DIBread is average daily intake by adults (g / day). Also, B.W represents the body weight of adults (Kg). However, the weight of adults' body in this study was managed to be (70 Kg) (Rasheed, 2021). Moreover, the average weight of bread was (300 gm / day) through of three meals that is the traditional way to eat.

Statistical Analysis

This study was carried out on the Tiry Bread and Samoon to indicate the content of some micro and macro minerals. The data obtained from this experiment was analyzed by XLSTAT-pro version (7.5.2.), a software for window. Then, the data obtained from the analysis samples were applied one way (ANOVA) with Duncan's multiple range tests at $P<0.05$.

RESULTS & DISCUSSION:

Some Macro and Micro minerals in Bread Flour:

Table (1) and Table (2) shows the concentration of Fe, Cd, Mn, Zn, Pb, Selenium (Se), Ni, Cu, Cr, As, Vanadium (V), Mo, Mg, Boron (B), Ba, and Antimony (Sb) in bread flour (wheat flour and barley flour). Moreover, the concentration of 16 minerals in the flour were used and indicated in this study. Also, the different concentration between flour and bread were clarified because the concentration of minerals in bread directly relate to the pollute soil, application of fertilizer, fungicide, pesticide, source of irrigation, environmental pollution, and water used in baking process. Furthermore, a high level of mineral contents in the consumed food can cause some human diseases (Awulachew, 2020).

The results of the minerals from bread flour showed that the concentration of Fe, Mn, Zn, and Cu from the barley flour for both TBF (28.967, 30.723, 20.445, and 4.989 mg/kg) and KBF (27.960, 29.83, 20.106, and 4.875 mg/kg) are higher than TWF (8.658, 4.370, 7.783, and 1.908 mg/kg). In addition, the statically analysis between both types of flour showed significant different ($P> 0.05$) in amount of Fe, Mn, Zn, and Cu. Moreover, the concentration of Cd, Pb, Se, Ni, and Cr were ranged between (0.032 – 0.035 mg/kg), (0.163 – 0.405 mg/kg), (0.4 – 0.445 mg/kg), (0.139 – 0.208 mg/kg) and (1.206 – 1.157) for all types of flour. However, that results did not estimate a significant different between various types of flour for Cd, Pb, Se, Cr, and Ni. However, the concentration of As in all types of flour through study was under dedicated limits.

Table (1): The concentration of (Fe, Cd, Mn, Zn, Pb, Se, Ni, Cu, Cr, and As) (mg /Kg) in bread flour.

Minerals	Barley		Wheat
	Turkish Flour	Kurdish Flour	Turkish Flour
Fe	28.967[a]	27.960[b]	8.658[c]
Cd	0.035[a]	0.032[a]	0.034[a]
Mn	30.723[a]	29.837[b]	4.370[c]
Zn	20.445[a]	20.106[b]	7.783[c]
Pb	0.163[b]	0.210[b]	0.405[a]
Se	0.445[a]	0.560[a]	0.400[a]
Ni	0.149[b]	0.139[b]	0.208[a]
Cu	4.989[a]	4.875[b]	1.908[c]
Cr	1.206[a]	1.126[a]	1.157[a]
As	NA	NA	NA

Whilst, the results of elements obtained from the barley flour (KBF and TBF) revealed that there were no statically significant different between elements. In addition, the concentration of V from TWF recorded (0.066 mg/kg), otherwise KBF and TBF contained (1.624 and 1.713 mg/kg). While, the concentration of Mg from barley for both KBF and TBF were below dedicated limits, and Mg concentration from TWF contained (333.704 mg/kg). Likewise, the concentration of V, Mo, B, Ba, and Sb from TWF showed the lowest range compared with TBF and KBF.

Table (2): The concentration of (V, Mo, Mg, B, Ba, and Sb) (mg /Kg) in bread flour.

Minerals	Barley		Wheat
	Turkish Flour	Kurdish Flour	Turkish Flour
V	1.713c	1.624b	0.660c
Mo	1.010a	1.010a	0.445b
Mg	0	0	333.704a
B	1.480a	1.367b	0.809c
Ba	4.038a	3.947b	1.769c
Sb	0.408a	0.259a	0.229a

Some Macro and Micro minerals in Tire and Samoon Bread

Data present in Table (3) and (4) indicated the concentrations of some (macro and micro nutrition) in Tiry bread and Samoon, which are produced from (wheat and barley flour) and illustrated the daily intake for each type of produced bread and the different types of flour with the provisional tolerable weekly intake (PTWI). The data shown in the following table for Tiry bread and Samoon were separately analyzed because the process of baking and methods of preparation for bakery are different from each other.

Despite, the macro and micro minerals used by low quantity for human body, even so they are most important roles to human health (Koubová *et al*., 2018). Iron is one of the essential minerals that is participate in most human metabolic processes

(Bresson *et al*., 2015; Nadir *et al*., 2020). Therefore, Fe in bread not great bioavailability for human because the breads contain Phytic acid, which impacts on bioavailability of Iron (Rasheed, 2020). The results observed in this study for Fe concentration in Tiry bread show the significant difference between wheat and barley flour, which is used for producing Tiry bread. The concentration of Fe in Barley Tiry Bread (BTB) recorded (28.452 mg/kg) and Fe concentration for Wheat Tiry Bread (WTB) was (14.93 mg/kg). Thus, content of Fe in Samoon showed significant different and the content of Fe in Barley Samoon (BS) recorded (19.594 mg/kg), even so Fe content in Wheat Samoon (WS) was (7.73 mg/kg).

However, the concentration of Fe from barley flour for both TBF and KBF are not significant changeable surrounding the baking process. Otherwise, the concentration of Fe from wheat flour is low compared to Wheat Tiry Bread (WTB), it is related to the water, salts and equipment used for producing dough and bread (Naghipour *et al*., 2014). In addition, the daily intake of Iron in Tiry bread (TB) ranged between (63.985 -121.937 µg/kg day) and for Samoon ranged from (33.128 - 83.974 mg/kg day), these results obtained a higher range than those suggested by FAO/WHO. And the PTWI recommended (392 µg/Kg). Otherwise, the daily intake of Fe from WS is in range of FAO/WHO (FAO & WHO, 2001).

Cadmium is the second mineral in this study we worked on because the exposure excess to the cadmium in a long period affects the human health (Jafari, & Birjandi, 2018). Likewise, cadmium affects the skin, kidney, breath, and liver (Pirhadi *et al*., 2022). The concentration of Cd in both Samoon and Tiry breads ranged between (0.029 – 0.044 mg/kg). In addition, Cd concentration is in a low range when compared to the FAO/WHO recommendations to Cd in food. Also, through the baking process Cd concentration shows a constant rate.

Manganese is another micro-mineral used by human body because of participation in carbohydrate, amino acid, and lipid, in several functions involved in to the bone formation and protection of cells (Organization, 1996; Haugen *et al*., 2019). In addition, a sufficient concentration of Mn for humans is approximately 55% of the total Mn concentration that comes from the cereal (Haugen *et al*., 2019). Also, the concentration of Mn obtained from the TBB, TWB, BS and WS (19.988, 10.157, 20.516, and 3.244 mg/kg) were decreased compared the flour used to the bread This decreasing of Mn concentration is due to the baking process. However, the concentration of Mn in TBB and BS are higher than the PTWI ratio of Mn. In another respect, the Mn concentration from the bread using wheat flour is in a low level of PTWI. 55% of sufficient Mn for human comes from the cereal (Organization, 1996), it is one of the most important micro-minerals involved in almost of all human body (FAO & WHO, 2001). In addition, Zn plays an important role in human health and contributes to the carbohydrate metabolism, synthesis of protein and DNA, conservation of (skin, heir, bones and nails), it has a huge role in the immune system (Organization, 1996; FAO & WHO, 2001; Elsa & Desmond, 2021). Also, the deficiency of Zn effects on the maturation of sexual skeletal and retardation of growth in humans (Elsa & Desmond, 2021). However, the toxicity of Zn affects on the some manifestation disease for human (FAO & WHO, 2001).

Table (3): The concentration of minerals in Tiry Bread and Samoon which is produced from the wheat and barley flour, and daily intake for each type of bread with PTWI (FAO/ WHO).

Minerals	Tiry Bread				Samoon				PTWI** in Reference	
	Barley (mg/Kg)	DI* (µg/Kg day)	Wheat (mg/Kg)	DI (µg/Kg day)	Barley (mg/Kg)	DI (µg/Kg day)	Wheat (mg/Kg)	DI (mg/Kg day)		
Fe	28.452a	121.937	14.930 b	63.985	19.594 a	83.974	7.730b	33.128	392	(FAO & WHO, 2001)
Cd	0.029a	0.124	0.036b	0.154	0.037a	0.158	0.044a	0.188	7	(Panel & Chain, 2011)
Mn	19.988a	85.662	10.157 b	43.53	20.561 a	88.118	3.244b	13.902	140-350	(Haugen *et al*., 2019; Organization, 1996)
Zn	12.000 b	51.428	16.322 a	69.951	16.476 a	70.611	6.385b	27.364	420-490	(FAO & WHO, 2001), (Jafari *et al*., 2018)
Pb	1.420a	6.085	0.201b	0.861	0.543b	2.327	0.878a	3.762	25	(Panel & Chain, 2010)
Se	0.451a	1.932	0.557a	2.387	0.649a	2.781	0.356b	1.525	20-50	(Organization, 1996), (Strand *et al*., 2018)
Ni	0.115b	0.492	0.129a	0.552	0.231a	0.99	0.178b	0.762	140 – 260	(Organization, 1996), (Schrenk *et al*., 2020)
Cu	3.764a	16.131	3.140b	13.457	3.435a	14.721	1.523b	6.527	500 - 2000	(Strand *et al*., 2018), (Babaali *et al*., 2020)
Cr	1.241a	5.3185	1.105b	4.735	1.036a	4.44	0.993a	4.255	30 – 250	(Pirhadi *et al*., 2022) ,(Opinion, Panel, Additives, & Sources, 2010)
As	2.542a	10.894	0.308b	1.32	0.118a	0.505	0	-	15 - 50	(Rasheed, 2021), (Authority, 2002)

*DI= daily intake of minerals, **PTWI= Provisional tolerable weekly intake from (FAO/ WHO)

In this study the concentration of Zn recorded (16.476 mg/kg) from BS, (16.332 mg/kg) from TWB, (12.0 mg/kg) from TBB, and (6.385 mg/kg) from WS, respectively. Thus, Zn concentration from the flour decreased that the bread due to losing of Zn occurred surrounding baking and prepared the dough. Otherwise, the

daily intake of Zn is under the level of toxicity compared to the data of FAO/WHO.

The results of this study showed that the average concentration of Lead found were (1.42 mg/kg) TBB followed by (0.878 mg/kg) for WS, (0.543 mg/kg) for BS, and (0.201 mg/kg) for TWB, that results show no significant difference between the bread. The daily intake of the concentration of Pb was under the level of permissible limit. However, Lead is a toxic trace metal that effect on human health (Panel & Chain, 2010). Foods are contaminated by two ways; one of the ways is natural and the other way is by anthropogenic activity (Brhane and Dargo, 2014). In addition, two forms of Pb can be found in the nature (organic and inorganic), both of them are different from each other in term of toxicity (Danamic and Kinetics) (G. Brhane and H.Dargo, 2014).

Besides, the concentration of Se, Cu, and Cr in this study showed that no significant different between the bread. The concentration of essential trace minerals of (Se, Cu and Cr) were obtained from TBB (0.451, 3.764 and 1.241 mg/kg), for TWB (0.557, 3.14, and 1.105 mg/kg), for BS (0.649, 3.435 and 1.036 mg/kg) and for WS (0.356, 1.523 and 0.993 mg/kg) respectively. Also, the daily intake for the Se, Cu and Cr shows the low in limitation range. However, the concentration of Se, Cu and Cr in a limitation range are very affective to the human health, otherwise, deficiency of Se, Cr and Cu affects the human health problem, such as vomiting, hair loss, irritation, liver and etc. (Opinion *et al*., 2010; Pirhadi *et al*., 2022) .

Nickel is measuring to the group of the micro-minerals that important to the human health, it has a different characteristic compared with other minerals because it can be easily combined with other minerals in a mixture form (Brhane and Dargo, 2014). In this study, Ni concentration found in this study was (0.115 mg/kg) from TBB, (0.129 mg/kg) from TWB, (0.231 mg/kg) from BS and (0.178 mg/kg) from WS respectively.

As a mineral has a toxic trace, which transportated from the nature due to the water (Arsenic, 2000). Organic form has more toxicity than the iorganic form (Koubová *et al*., 2018). Thus, exposure to the As in high concentration causes gastrointestinal, lung cancer and Eczematoid symptoms in humans. The concentration of As obtained from this study orders as follows: TBB (3.542 mg/kg), TWB (0.308 mg/kg), BS (0.118 mg/kg, and from WS concentration under concentration revealed from this study were obtained under allowable limit.

Table (4): The concentration of minerals in Tiry Bread and Samoon which is produced from the wheat and barley flour, and daily intake for each type of bread.

Minerals	Tiry Bread				Samoon			
	Barley (mg/Kg)	DI* (µg/Kg day)	Wheat (mg/Kg)	DI (µg/Kg day)	Barley (mg /Kg)	DI (µg/Kg day)	Wheat (mg/Kg)	DI (µg/Kg day)
Sb	0.426a	1.825	0.368a	1.577	0.401a	1.718	0.314b	1.345
Ba	3.251a	13.932	1.586b	6.797	3.929a	16.838	2.712b	11.622
B	1.678a	7.191	0.973b	4.17	0.995a	4.264	0.468b	2.005
Mg	0	-	588.343a	2521.47	0	-	264.097a	1131.844
Mo	0.710b	3.042	0.789a	3.381	0.714a	3.06	0.292b	1.251
V	0.720b	3.085	0.969a	4.152	1.608a	6.891	0.576b	2.468

*DI= daily intake of minerals

Cereal crop is an essential source of minerals, especially wheat, due to presence of more micro and macro nutrients in it (Tejera *et al*., 2013). Besides, one of the essential macro-minerals is Mg. The Mg content in this study were found (588.343 mg/kg) for TWB, and (264.097 mg/kg) for WS. Furthermore, Mg content were not indicated from TBB and BS. However, the highest Mg content was found in cereal crops compared to other food, as well as the phytic acid and dietary fiber in cereal crops likely help to decreasing bioavailability (Food, 2006). In one hand, the deficiency of Mg caused a weakness, high blood peruses, cramps, irregular heartbeat and more (Authority, 2002). In other hand, the Mg contributes to the bone, cell division, nervous system and teeth (Ciudad-Mulero *et al*., 2021).

The concentration of Sb is higher from TBB (0.426 mg/kg), followed by BS (0.401), and TWB (0.368 mg/kg), and the lowest concentration was obtained from WS (0.314 mg/kg). In addition, the results of Sb in different bread show no significant difference between various bread. Thus, the excesses of strontium in human body directly affected the skeleton and no systematic bone development (Koubová *et al*., 2018).

The highest content of barium reached (3.929 mg/kg) from BS. The lowest was obtained from TWB (1.586 mg/kg). These results of barium concentration are in accordance with published data. So, that result revealed the concentration of Ba from the bread produced from the barley flour are higher than the bread produced from wheat flour. Also, the content of boron in breads was monitored between (0.995 - 1.678 mg/kg) for both breads that produced from barley flour.

Vanadium content in bread ranged between (0.576 – 1.608 mg/kg) from WS and BS. V is less, it is a toxic in a small ratio, as well as deficiency and toxicity of V directly affected on human health (Organization, 1996).

Even though Mo is an essential mineral, the concentration of Mo in bread similarly ranges from (0.293 – 0.789 mg/kg). Cereals crops generally contained high concentration of Mo (Khouzam & Lobinski, 2012). However, those results obtained through experiment and compared to those of the study were finding illustrated from Table (5). In addition, those results obtained in this study agree with the results or estimated the same results of the most studies carried out before. In addition, the bread produced from this study with the mineral content indicated, through this study, that the daily intake and PTWI were lower than the recommended PTWI, which is provided by FAO/WHO.

The mineral contents in food and bread and contamination of bread affected by some factors. Environment is the main source to contaminate bread by polluted from the anthropogenic activity, soil pollution (Brhane and Dargo, 2014). The second main source is filed activity by farmer, such as application chemical fertilizer, pesticide, fungicide and chemical weed control (Rasheed, 2021). The third main source of contaminate and transfer minerals to the bread is through backing process (Koubová *et al*., 2018). The process of baking uses some stuff like oven and Saj. Then, adding water, salt and soda to the dough (Babaali *et al*., 2020). Also, some other sources such as, packaging, baking air pollution are the secondary source to contaminate bread (Rasheed *et al*., 2020).

Table (5): Comparison of the obtained results for macro and micro minerals in bread with other author's results (mg/kg).

Minerals	Concentration in a resend study	References
Fe	(17.0 – 26.2), (26.487 – 34.278), (1.05 – 1.45)	(Rasheed, 2021), (Feyzi *et al*., 2016), (Adebola, 2020)
Cd	(0.025 – 0.3), (0.0115 - 0.00323), (0.00612- 0.0128)	(Naghipour *et al*., 2014), (Rasheed, 2021), (Feyzi *et al*., 2016)
Mn	(44.28 – 78.25), (2.80 -6.10), (2.8 – 42)	(Irogbeyi, Nweke, Akuodor, Unekwe, & Asika, 2019), (Adebiyi, Ore, & Ojile, 2022), (Maher & Nowak, 2022)
Zn	(2.23 – 6.63), (8.875 – 16.909), (10.163 – 36.145)	(Irogbeyi *et al*., 2019), (Feyzi *et al*., 2016), (Abou-Raya, Shalaby, Kassem, El-Dahshan, & Ibrahim, 2007)
Pb	(1.3 – 3.3), (0.1184 – 0.0083), (0.06- 0.15)	(Naghipour *et al*., 2014), (Rasheed, 2021), (Irogbeyi *et al*., 2019)
Se	(0.0048 – 0.0531), (0.03 – 0.32)	(Maher & Nowak, 2022), (Khouzam *et al*., 2012)
Ni	(0.24 – 2.4), (0.149 - 0.243), (0.843 – 0.112)	(Naghipour *et al*., 2014), (Rasheed, 2021), (Feyzi *et al*., 2016)
Cu	(0.31 – 0.49), (2.1343 – 2.4375), (28 – 54)	(Irogbeyi *et al*., 2019), (Feyzi *et al*., 2016), (Abou-Raya *et al*., 2007)
Cr	(0.7 – 2.8), (0.0151 – 0.0649), (6.40 – 10.20)	(Naghipour *et al*., 2014), (Rasheed, 2021), (Abou-Raya *et al*., 2007)
As	(0.00927 - 0.0196), (0.0125), (0.0024 – 0.0568)	(Rasheed, 2021) , (Feyzi *et al*., 2016), (Maher & Nowak, 2022)
Sb	(0.6364 - 0.136)	(Khouzam *et al*., 2012)
Ba	(1.14 – 2.94)	(A. STRASHEIM, 1967)
B	(0.090 – 6.850)	(Maher & Nowak, 2022)
Mg	(226.7 – 226.4), (240 – 1420), (181.25 – 243.25)	(Tejera *et al*., 2013), (Maher & Nowak, 2022), (Geleta & Kibatu, 2021)
Mo	(0.00003), (0.13 – 0.84)	(Maher & Nowak, 2022), (Khouzam *et al*., 2012)
V	(0.04 – 0.1)	(Khouzam *et al*., 2012)

CONCLUSIONS

Bread is an integral part of society, as well as cereal products positively influence human health and nutrition. So, the results of current study revealed that the baking processes applied by this study on bread have a huge impact on the minerals content and confirm that the safe food to consume. Kind of baking and stuff help to increase the concentration of some minerals and check the flour imported into or produced inside the country during quarantine processes to confirm the concentration to be not polluted from production area and transporting or storage. Thus, the recommendation of the current study is to bakery shops and people who made bread in home to confirm that the cleaning all parts of baking process. Additionally, bread processing needs future studies to confirm the quality and safety of bread.

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CONFLICT OF INTEREST

The authors state that there are no conflicts of interest regarding the of this publication manuscript.

تأثير المعالجة المعدنية على القمح والشعير (خبز تيري وسمون كمثال)

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الخلاصة

خبز (تيري وسمون) ، خبز خاص وحيوي في اقليم كردستان العراق ، يأكله الناس يومياً في وجباتهم. يحتوي خبز تيري والصمون على بعض المعادن الدقيقة والجزئية. أيضا، استهلاك الخبز هو مسار دخول المعادن الثقيلة في السلسلة الغذائية. في هذه الدراسة، تم استخدام دقيق القمح والشعير لإنتاج خبز تيري والصمون، وقد تمت الإشارة إلى بعض المعادن الدقيقة والجزئية في دقيق (القمح والشعير) والخبز الذي ينتجهما. بالإضافة إلى أن تأثير المعادن في الخبز والصمون يظهر على صحة الإنسان لفترة طويلة. تمت الإشارة إلى ما مجموعه 16 معدنًا من الخبز والطحين بواسطة البلازما الحثي المزدوج (ICP). تم الحصول على أعلى تركيز للحديد، CD، Mn Zn، Cu، و Cr من دقيق الشعير التركي (28.967، 0.035، 30.723، 20.445، 4.989، 1.206 مجم / كجم). علاوة على ذلك، تم الحصول على أعلى V و Mo و B و Ba و Sb من 1.713) TBF، 1.01، 1.48، 4.038، 0.408 مجم / كجم). أظهرت نتائج الدراسة أن تركيز (Fe، Cd، Mn، Zn، Pb،

(Sb and As ،Ba ،Mg ،B ،Mo ،V ،Cr ،Ci ،Ni ،Se) في نطاق محدود مقدم من منظمة الأغذية والزراعة. /من. أيضا ، المدخول اليومي و PTWi في بعضها مرتفع. ولكن ليس أعلى من نطاق القيد.

الكلمات الدالة: خبز تيري ، صمون ، المدخول اليومي ، المعادن ، دقيق القمح.

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