Comparison Study of Trace and Toxic Minerals in Local and Imported Rice in Sulaimani– Iraq

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ABSTRACT— ***Trace and toxic minerals level in eight varieties of (Oryza sativa L.) from Sulaimani, Iraq were determined by Atomic Absorption spectrometry. The content of trace minerals in Iraqi and Imported rice were found in the ranges:0.566 – 0.04 mg/kg for Iron, 10.29 – 0.001 mg/kg for Zinc, 0.036 – 0.007 mg/kg for Copper, 0.035 – 0.001 mg/kg for Cadmium, 0.62 – 0.01 mg/kg for Lead. Results obtained are in accord with data reported by WHO/FAO.***

Keywords— Kurdistan, Ration Card, Trace Minerals, Atomic Absorption Spectrometry

1. INTRODUCTION

Rice (Oryza sativa L.), belonging to the Poaceae family, is the staple food of roughly half of the population worldwide [1]. Approximately, 90% of world's rice is cultivated and consumed in Asia countries [2], with a daily consumption (200 – 400 g) per person [3]. In the northern of Iraq - Kurdistan, rice is therefore consumed as the main staple food.

Minerals are clearly required in different amount, based on the element, to provide a good health [4]. Minerals are a small class of micronutrients, most of which are considered important [5]. Trace minerals are needed in tiny amount by the body compare to others e.g. Iron , Copper, Zinc, chromium, lead and cadmium [6]. However, some of these minerals are considered as essential elements including iron, copper and zinc, while lead, chromium and cadmium have toxic roles in the body during biochemical reaction. Also too much intake of zinc has been reported to be toxic [7, 8, 9]. The level of trace minerals in plants is variable, because it is affected by the characteristic of a soil, however some other source of toxic like fertilizer, rainfall, traffic density and environment affect the level of toxicity of these elements [10].

Trace minerals analysis of rice is significant on an essential, nutritional and toxicological level. It contains relatively high contents of essential trace elements. Trace minerals are important for development and normal growth because they play vital role in sugar metabolism, nerve function, cardiac function and activity various enzymes [11]. Despite their importance human health is affected by the contaminated rice of higher level of cadmium (Cd), lead (Pb) and other metals [12]. In the early of 20th century, mass cadmium poisoning was happened in Japan and hundreds of people were poisoned [3]. The aim of this study is to compare trace and toxic minerals content between eight verities of rice in Sulaimani province. To confirm sufficient and safe level of trace minerals in those tested samples.

2. MATERIALS AND METHODS

2.1 Material

The tested materials included three Iraqi varieties (Oryza sativa L.); (Banixelan, Shexlangar and Banisuq) and popular imported rice (American, Thailand, Russian, Indian and Ration Card) origin. Samples were purchased from the local market, Sulaimani, Iraq. Iraqi varieties were widely cultivated in Sulaimani region (marked as A), imported varieties were imported broadly in the other countries (marked as B).

2.2 Analytical methods Food sample preparation

The analytical samples were prepared by the following procedure, which was described by Britain et al., (1973) and Nielsen (2010). Samples were digested with dry ashing methods: one gram of samples in a crucible was placed in a muffle furnace at 450 C° for 14 hrs. After cooling, approximately 5ml of 6M hydrochloric acid was added and evaporated on water bath to dryness. The residue was moistened with approximately 1ml of 36% hydrochloric acid, and also slowly evaporated to dryness. Then, 5ml of water was added and to the mark and analysed by Atomic Absorption spectrophotometer.

2.3 Determination of trace minerals in rice

The concentration of Iron, Zinc, chromium, lead and cadmium in prepared samples were determined by using Atomic Absorption spectrophotometer (Shimatsu model No. AA-7000).

2.4 Data Analysis

Values are given as mean ± standard deviation; Microsoft Excel was used to analysis the data

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3. RESULTS AND DISCUSION

3.1 Concentration of trace and toxic minerals in Iraqi and Imported rice

Concentration of trace and toxic minerals in both Iraqi and Imported rice are presented in Table 1. To facilitate comparison and evaluation the samples the concentrations were also superimposed in figures. Trace element can be found as normal constituent in rice, therefore detection within the low mg/kg range was essential. The highest Iron (Fe) level (0.566 mg/kg) was found in Shexlangar rice, with the lowest level (0.239 mg/kg) in Banixelan types as shown in Figure 1.Whereas the highest Zn content was recorded in Banixelan (0.301 mg/kg)(Figure 2).The mean Copper content in Indian and Banisuq rice were0.368 and0.312 mg/kg, respectively, which higher than other samples (Figure 3).Cadmium was the only element for which concentration did not appear any values in Banixelan, Banisuq American and Russian varieties of rice, whereas the highest concentration (0.043 mg/kg) was found in Indian varieties (Figure 5), Finally, the lowest Pb level (0.012mg|kg) was found in Thailand rice, and the highest concentration (0.627 mg\kg) was found in Russian rice.

Table1; Trace minerals concentration (mg/kg) in eight different varieties of Iraqi and imported rice

Trace Minerals	**Iraqi Rice (A)**				
	Banixelan	**Shexlangar**	**Banisuq**		
Pb	0.035±0.061	0.061±0.056	0.044±0.052		
Cd	0±0	0.021±0.030	0±0		
Fe	0.37±0.239	0.566±0.370	0.343±0.310		
Zn	0.301±0.042	0.291±0.226	0.156±0.133		
Cu	0.043±0.011	0.078±0.064	0.312±0.008		
Trace Minerals	**Imported Rice (B)**				
	Ration Card	**American**	**Russian**	**Indian**	**Thailand**
Pb	0.470±2.388	0.492±0.057	0.627±0.058	0.056±0.096	0.012±0.021
Cd	0.025±0.013	0.035±0.035	0.026±0.006	0.034±0.06	0.001±0.003
Fe	0.312±0.298	0.061±0.018	0.040±0.024	0.219±0.255	0.456±0.37
Zn	6.322±10.762	0.045±0.044	0.011±0.019	0.158±0.17	10.29±9.3
Cu	0.030±0.036	0.0007±0.001	0.0007±0.001	0.368±0.552	0.078±0.035

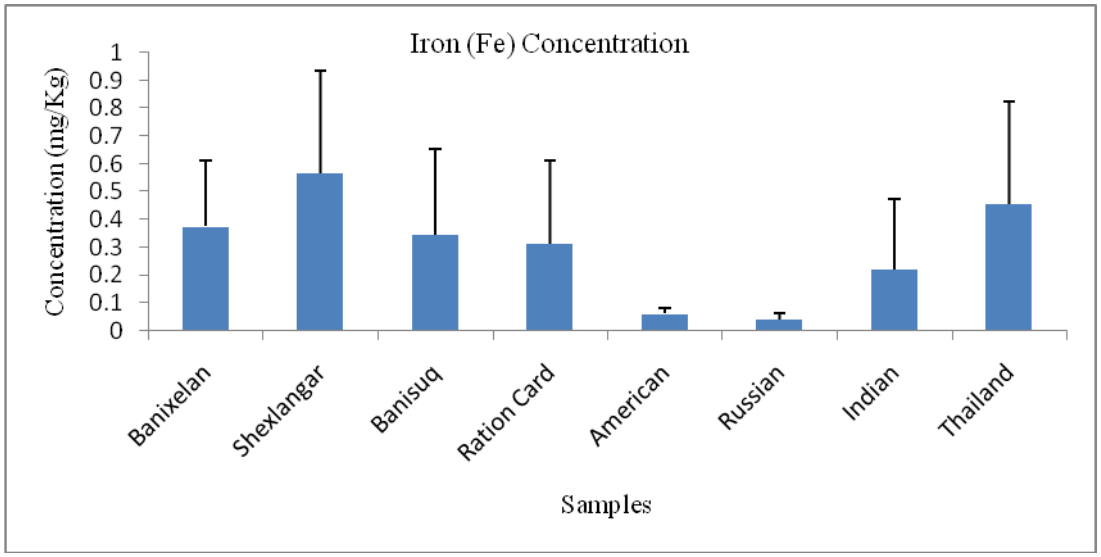

Figure 1: The mean of total iron content (measured as mg / Kg) in eight different varieties of Iraqi and imported rice samples

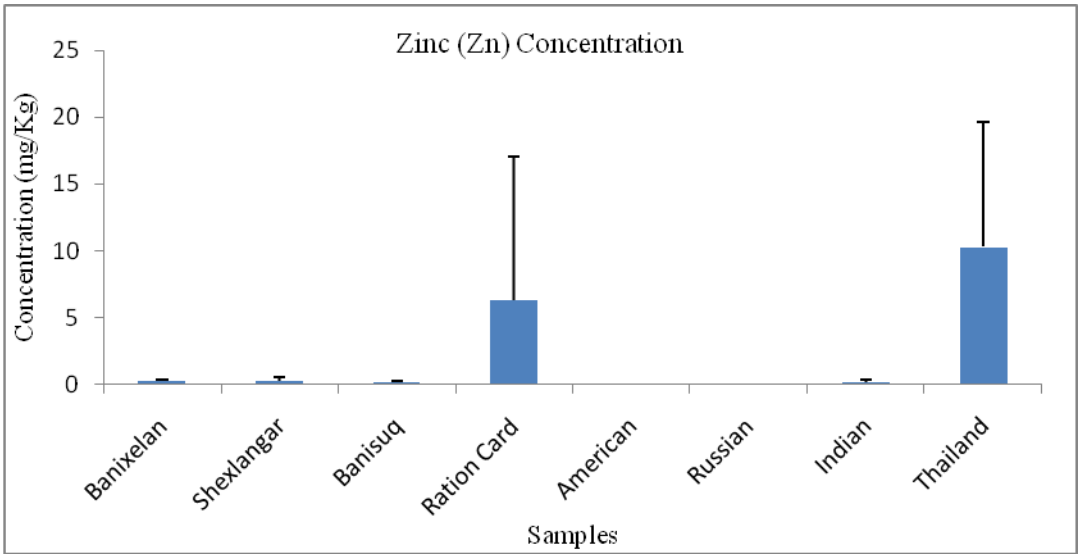

Figure 2: The mean of total Zinc content (measured as mg / Kg) in eight different varieties of Iraqi and imported rice samples.

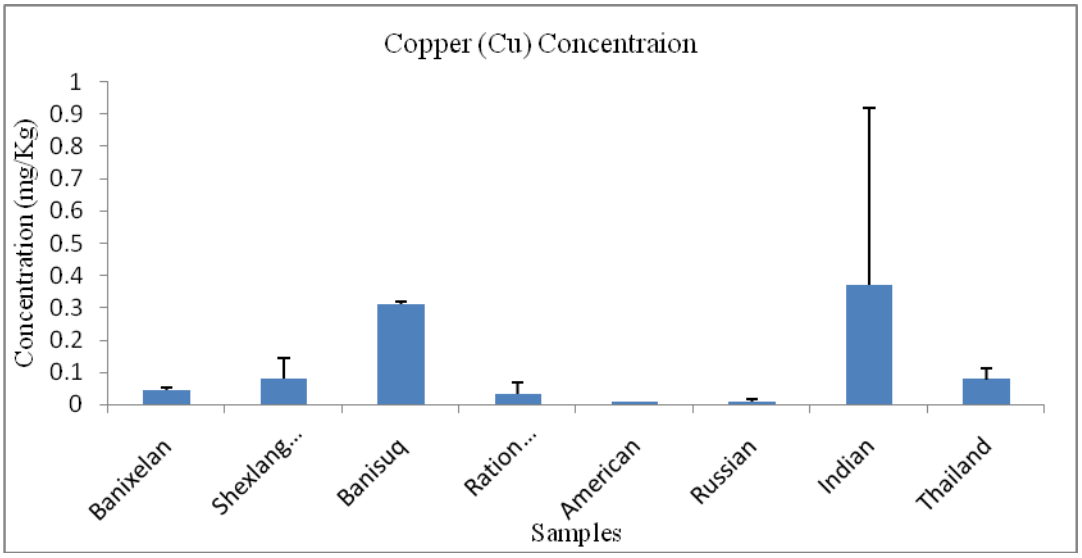

Figure 3: The mean of total Copper content (measured as mg / Kg) in eight different varieties of Iraqi and imported rice samples

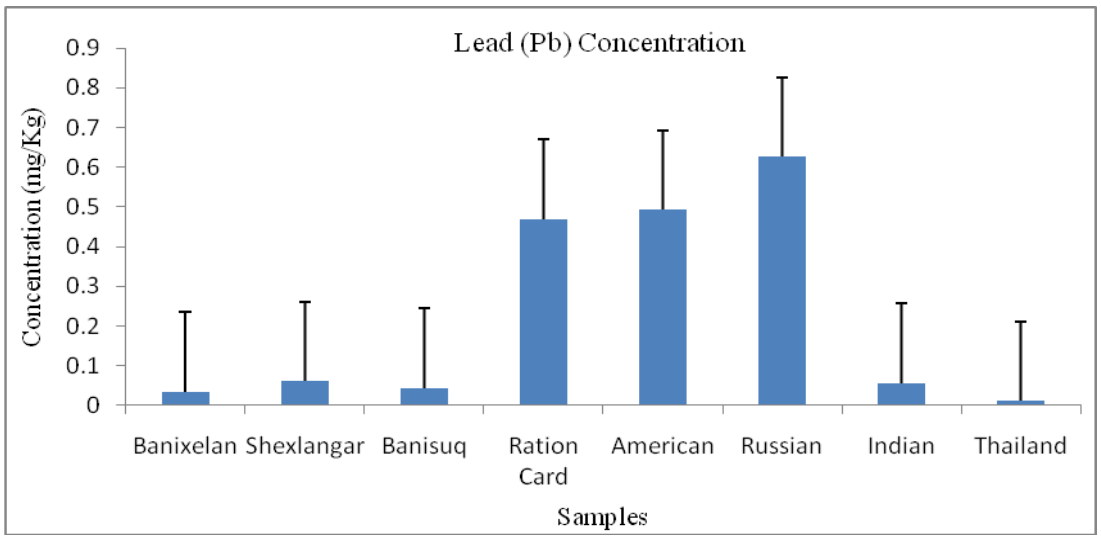

Figure 4: The mean of total Lead content (measured as mg / Kg) in eight different varieties of Iraqi and imported rice samples.

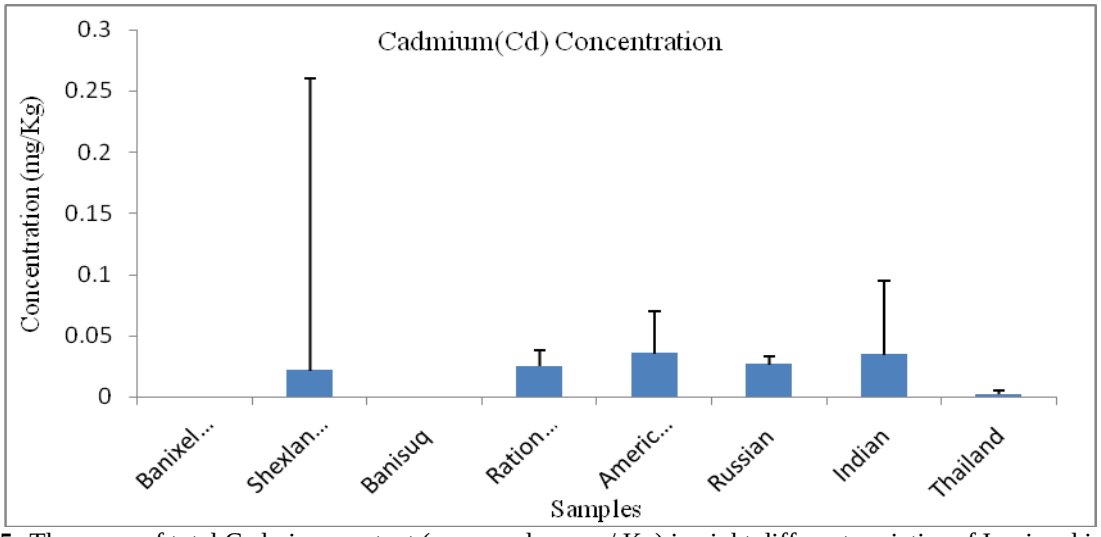

Figure 5: The mean of total Cadmium content (measured as mg / Kg) in eight different varieties of Iraqi and imported rice samples.

The data from this study indicates that imported rice analysed in this study are contaminated with lead and this contamination is at its highest in three of the imported rice samples (American, Ration Card and Russian),.While the lowest concentration was found in Iraqi verities, Indian and Thailand samples. In comparison with WHO/FAO data, the level of lead (Pb) was two times above the value reported for rice (0.3 mg/kg) by WHO/FAO [13].

Cadmium is toxic and non-essential element for humans. Human's exposure to Cd occurs from ingestion of contaminated food [14]. Results obtained for Cd revealed that the concentrations of cadmium were relatively very low ranges from 0.0 to 0.034 mg/kg. The mean Cd Concentrations in imported rice were 0.025, 0.035, 0.026, 0.034 and 0.001 mg\kg in Ration Card, American, Russian, Indian and Thailand, respectively, those are higher than Iraqi varieties samples. Cadmium was not detectable in Banixelan and Banisuq, while it was found with the rate of 0.021 mg\kg in Shexlangar. Generally, this concentration is within the range accepted globally as a safe limit (0.3 mg/kg) by WHO/FAO [13, 15]. However, Lead and cadmium are toxic at very low exposure levels and have both acute and chronic effects on human health and the environment [16].

The rice samples contained different levels of copper were ranged from 0.030 to 0.368 mg/kg. The level of cu in both Iraqi and Imported varieties samples were much lower than those reported for rice (40 mg/kg) by WHO/FAO [13, 15].

Zinc and Iron are an essential element in human diet as it is required to maintain the function of human system. In this study, the concentration of Zn and Fe in all the test samples varied between 0.011 mg/kg to 6.322 mg/kg and 0.040 mg/kg to 0.566 mg/kg respectively. Fe has the highest concentration in Iraqi rice, compared with imported rice, the highest level was found in Shexlangar type (0.566 mg\kg), while the lowest value was found in Banisuq type (0.343 mg\kg). Previous literature survey indicates that Indian and Thailand rice was contained (0.08 mg\kg) and (12 mg\kg) iron [13]. In addition, the highest concentration of Zinc was found in imported rice of Ration Card type (6.322 mg\kg) and Thailand type (10.99 mg\kg), while the lowest value was found in Russian type (0.011 mg\kg). In this situation, the Fe and Zn contents of our rice samples were found in safe limit.

4. REFERENCES

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