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FULL PAPER

Detection of lead and cadmium in types of chips from local markets in Baghdad

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Twenty-six samples of chips were examined by 13 chips samples as well as 13 samples of chips corn and all examined samples were analyzed by using the Flame Atomic Absorption Scale (AAS_7000) to determine the compositions of the studied items. All results were reported with lead above the permissible limits, cadmium concentrations did not appear above the permitted limits, and the results of lead compositions (PPM) for potato chips (0.5425 and 0.5158), while the results of cadmium compositions (PPM) for potato chips were (0.0102 and 0.0065), as counted for averages and standard deviation, lead and cadmium ranges were (0.126, 0.211, 0.0003-0.542, 0.0005, 0.0004, and 0.0-0.0011), respectively for lead and cadmium compositions (PPM) in corn chips. The results of lead compositions (PPM) for corn chips were (1.0444 and 0.7464), while the results of cadmium compositions (PPM) for corn chips were founded as (0.0098 and 0.0050), as accounted for averages and standard deviation, lead and Cadmium, ranges were (0.189, 0.317, 0.0003-1.0044, 0.0003, 0.0003, and 0.0-0.001), respectively. Therefore, all results indicated lead > cadmium for all varieties.

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KEYWORDS

Potato chips; corn flakes; heavy metals; Atomic Absorption Spectrum Device (7000_FAAS); local markets; Baghdad City.

Introduction

Chips are fried foods and are mentioned among fast foods made from potatoes or corn which contain a variety of artificial ingredients [1]. Frying and additions of salts, spices, and others increase the risk of food products containing chemical pollutants mainly originating from the environment [2]. The presence of heavy metals is a negative indicator in these foods which are transmitted through food chains [3,4]. Unhealthy packaging by human sources and agricultural activity lead to increase the levels of these minerals [2,5]. The heavy metals are constant pollutants in the environment, some of which are necessary to maintain activity and metabolism, others have no role in biologic and the concentration of these metals when they increase cause toxicity to living organisms, even including the basic body minerals of lead from toxic and non-essential metals even in low doses [6,7] that affects blood, genitals, and nervous system and also affects cognitive function in the body and IQ [8,9,10]. Lead is mainly absorbed from the skin, respiratory, and digestive tract and simultaneous exposure to one or more minerals with cumulative effects terribly [10,11,12]. The whistling age groups are more sensitive than adults towards heavy metals in which the absorption rate is high by the digestive system and high food consumption for the body mass and the

incomplete brain barrier. These food products have a growing demand among age groups, especially for school students and kindergartens, more specifically based on a survey conducted in our study of age groups between 4-19 years old in kindergarten, primary, and middle school [13,14]. 200 random samples in schools and kindergartens for each age stage, about eating chips and preferring it over other products. In this regard, the ratios depicted in Table 1 are evidence of diversity consumer desire for these food products and this confirms the accumulation of minerals in these bodies. These minerals are dangerous to the health of consumers, especially vulnerable groups, most notably young age groups. This research aims to provide some suggestions on the presence and severity of these minerals in these food products.

Materials and methods

Sampling

Samples were collected from March to April, 2021, from different areas in the local markets, consisting of Shura, beautiful industrial, shops, malls, school shops, and 26 samples, including 13 potato chips and 13 corn chips in Table 2. These are the most available samples on the market.

Preparing samples

Samples were taken from each product and kept in 10*10 cm polyethylene bags and were sterile to avoid contamination. Then, the samples were recorded sequentially, were kept in appropriate cooling, and transferred to the examination center as soon as possible.

Quality assurance

The equipment was washed to avoid contamination with the element which is analyzed, where the pots and glass utensils were thoroughly cleaned with water distilled by using ionic water. Then, they were soaked in hot HNO diluted nitric acid at a concentration of 10% for 24 hours, rinsed several times with ionized water, and were dried to ensure that they are free of minerals [15].

Incineration and digestion

Five gram of each powder sample was weighed with an air-insulated sensitive balance and placed in an eyelid inside the 50mL incineration oven for 5 hours. Each sample was then digested by adding a combination of HCL at a concentration of 10mL and ion water by 1:1 with constantly stirring until digestion was complete, was placed over hot plat until the solvent evaporates, and then each sample was filtered with milipore filter paper 0.45, cooled and placed with a 50 mL volume bottle and the size was complemented with distilled water removed by 1:9 to the mark [16].

Sample examination

All samples were examined in the Atomic Absorption Laboratory at the Market Research and Consumer Protection Center/ Baghdad University/ Al-Jadriya Complex and were examined by the Atomic Absorption Spectrum Device (7000_FAAS) from Shimadzu of Japan. The specifications of the examination are provided in Table 2.

Statistical analysis

The averages and standard deviation of the obtained data have been calculated. The one-way variance analysis (LSD/ANOVA) was utilized to identify moral differences at probability level (P=0.05).

Results and discussion

The results of the questionnaire were for 800 random samples, as reported Table 3, including 400 males and 400 females and in

fact 200 samples per age group, those aged 2-5 years old preferred to eat such foods. 85 subjected in age ranges of 5-12 preferred to eat chips were estimated as 90%, those aged 12-15 were 81%, and finally the 15-19 age group, were approximated as 69%. Figure 1 displays these ratios. Likewise as indicated in Table 4, the results of our current study of Lead and Cadmium (PPM) were (0.0003, 0.1340, 0.0006, 0.0004, 0.5425, 0.0797, 0.2997, 0.2052, 0.3229, 0.0641, 0.1346, 0.5159, 0.4430, 0.0013, 0.0012, 0.0013, 0.0015, 0.0031, 0.0009, 0.0003, 0.0043, 0.0002, 0.0065, 0.0036, 0.0007, and 0.0102), respectively. Figure 2 illustrates the concentrations of the studied elements. Table 5 reports the concentrations of corn chips samples for lead and cadmium (PPM) as (0.2993, 0.3542, 0.0006, 0.0005, 1.0444, 1.0009, 0.1111, 0.0126, 0.0042, 0.2601, 0.7464, 0.0005, 0.4227, 0.0013, 0.0011, 0.0050, 0.0014, 0.0101, 0.0014, 0.0019, 0.0011, 0.0013, 0.0098, 0.0015, and 0.0013), respectively. Figure 3 depicts the concentrations of the studied elements, and in our current study, all the results indicated the presence of lead in samples and mostly above the allowable limits of 0.2 (PPM) [17,18,19]. As for cadmium, all samples demonstrated its presence, and the compositions did not exceed the permissible limits [18,19,20]. Lead and cadmium are toxic and harmful to consumer health, although their proportion is low due to their bioaccumulation capacity [21].

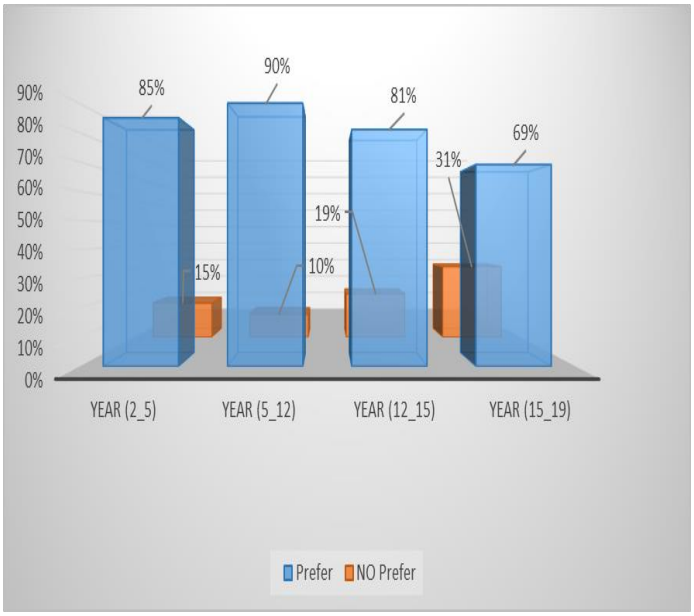

FIGURE 1 The classification of questionnaire in age groups

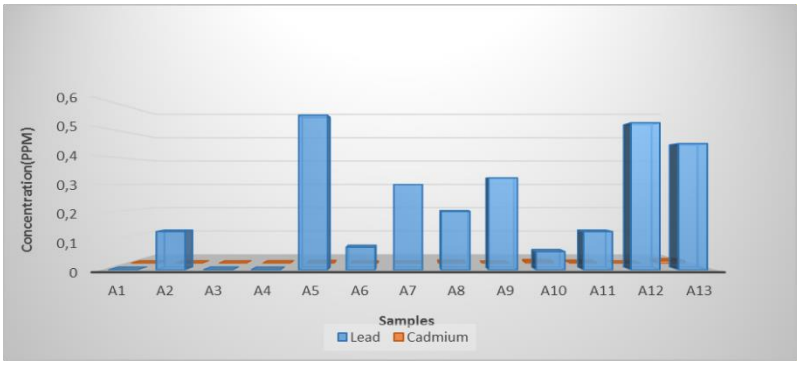

FIGURE 2 The concentrations of lead and cadmium in potato chips samples

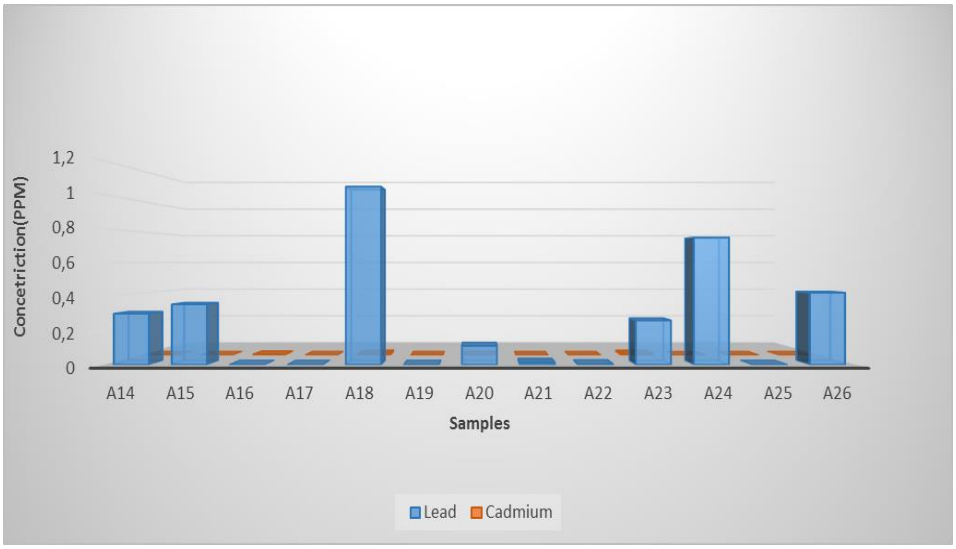

FIGURE 3 The concentrations of lead and cadmium in corn chips samples

TABLE 1 The utilized chips samples in the study

Samples	Type
Mask, Liz, Mes Mes, Karrada, Brangles, DaDa, ALkanese, ALmoen, Sheese, Jackie, Windin, NiNi, and Rose Shami.	Chips potatoes
Caesar, Amreek, BASE, Tommy, Layoonk, Mesk, BADR, Mahmoud Alwan, Windows, Cloan, CHIPS, Amooaj, and NICE.	Chips corn

TABLE 2 The inspection specifications of lead and cadmium element

The used gas	Slit width	Iberian	Wavelength	Item
Acetylene	cm10	MA 0.40	Nm 228.8	Lead
Acetylene	cm10	MA 0.40	Nm 283.3	Cadmium

TABLE 3 The classification of questionnaire in age groups

School stage	Kindergarten	Primary	Middle l	Secondary
Age group	**5-2 years old**	**5-12 years old**	**12-15 years old**	**15-19 years old**
No. of samples	200	200	200	200
Preferred	85%	90%	81%	69%
Not Preferred	%15	%10	%19	%31

TABLE 4 Lead and cadmium level (PPM) in potato chips

Item	Sample code	Lead	Cadmium
Potato chips	A1	0.0003	0.0013
	A2	0.1346	0.0012
	A3	0.0006	0.0013
	A4	0.0004	0.0015
	A5	0.5425	0.0031
	A6	0.0797	0.0009
	A7	0.2993	0.0003
	A8	0.2052	0.0043
	A9	0.3229	0.0002
	A10	0.0641	0.0065
	A11	0.1346	0.0036
	A12	0.5158	0.0007
	A13	0.4430	0.0102
Total		2.7430	0.0351

TABLE 5 Lead and cadmium level (PPM) in corn chips

Item	Sample code	Lead	Cadmium
Corn chips	A14	0.2993	0.0013
	A15	0.3542	0.0011
	A16	0.0006	0.0050
	A17	0.0005	0.0014
	A18	1.0444	0.0101
	A19	0.0009	0.0014
	A20	0.1111	0.0019
	A21	0.0126	0.0011
	A22	0.0042	0.0013
	A23	0.2601	0.0098
	A24	0.7464	0.0001
	A25	0.0005	0.0015
	A26	0.4227	0.0013
Total		3.2575	0.0373

TABLE 6 The averages, range, and SD for chips samples

Item	Item	SD+ Average Range	Less concentration, more concentration	More samples than allowed	No. of tested samples
Potato chips	Lead	0.126+0.211 0.0003_0.542	0.0003 0.5425	10 %76	13
	Cadmium	0.0005+0.0004 0.0_0.0011	0.0003 0.0102	0 %0	13
Corn chips	Lead	0.189+0.317 0.0004_1.0440	0.0005 0.7464	7 %53	13
	Cadmium	0.0003+0.0003 0.0_0.001	0.0001 0.0101	0 %0	13

Conclusion

Detection of lead and cadmium elements with local and imported chips was done in local markets and compared with global and local determinants due to the health problems which they cause.

Recommendations

1- Follow-up the imported sources and local raw food which enter the chips industry and enhance the role of the concerned authorities to examine these products for the presence of heavy metals and impose the essential measures.
2- The factory follow-up of used materials for manufacturing of additives, salts, spices, and other foodstuffs, because they are major sources of accumulation of these heavy metals.
3- Use alternative foods free of these pollutants.

Activate health and educational roles for how to reduce these pollutants and educate consumers about them.

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Ethical issues[1]:

Name the ethics committee that has approved the study?

Scientific Committee for analytical chemistry

Competing interests: None

[1] If the manuscript is Original Article or Review, this field should be filled. (**manuscript is Original Article**)

Authors' contributions: Analytical chemistry

Important note: All fields should be completed by authors

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