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Original article

Estimation of Some Heavy Metals Concentration in Potato Chips Samples

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ABSTRACT

Aims*. This study was conducted to determination of concentration of some heavy metals (cd, fe) in potato chips samples due to essential or toxic nature of this metals and due to increase consumption of potato chips especially by children.* ***Methods****. In the present work, the level of cadmium and Iron in some potato chips samples from Libyan markets were determined by: Flame and graphite furnace atomic absorption spectrophotometry thermo GF95), Germany.* ***Results****. The study recorded presence of this heavy metals in all samples in different concentrations. Cadmium concentration ranged from 0.2950 mg/l to 1.8300 mg/l, whereas iron concentration ranged from 17.5767 mg/l to 32.1390 mg/l. All samples contained heavy metals in different concentrations. Some of these metals are present in high concentration especially cadmium and iron.* ***Conclusion****. The results showed that some samples contain these metals in a percentage above the permissible limit, this exposes consumers of these products to the risk of developing serious health problems such as cancer.*

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INTRODUCTION

The development in the food industry and the fast pace of life has resulted in people turning to ready-to-eat foods for their easy accessibility and availability in stores. Potato chips are one of the ready-to-eat foods that are most consumed, especially by children, so determining the percentage of heavy metals in them is important. Heavy metals are one of the food contaminants that are not intentionally added to the food, but rather enter the food during the production process. Starting from the agricultural soil down to the manufacturing process and packaging in factories [1]. The effect of these minerals is a cumulative effect, as they accumulate in the vital organs of the body and it takes a long time to show their effects on the body and cause serious diseases [2].

All previous studies on potato chips proved the presence of heavy metals in them in different proportions [3]. Some heavy metals such as cobalt (Co), copper (Cu), chromium (Cr), iron (Fe), magnesium (Mg), manganese (Mn), nickel (Ni), selenium (Se) and zinc (Zn) are Considered necessary for the vital functions of the body in specific proportions, and some minerals Like lead (pd), cadmium (cd) is toxic even in trace amounts [4].

Iron is an important mineral for the human body, It is necessary for the synthesis of oxygen transport proteins in the body, in particular hemoglobin and myoglobin, and as co factor or for the formation of heme enzymes and other iron-containing enzymes like : catalase , xanthine oxidase, aconitase, reduced nicotinamide adenine dinucleotide and others and producing red blood cells [5,6].

Anemia is the most important manifestation of iron deficiency in the body, resulting in a decrease in the distribution of oxygen in the body due to a decrease in the production of hemoglobin and myoglobin. In addition to other functional impairments as a result of reduced activities of iron-dependent enzymes, fatigue, and general ill health. Iron deficiency in pregnant women is linked to problems with low birth weight and premature birth. In addition, some studies have shown that iron deficiency anemia causes cognitive impairment in school-age children and poor growth [7].

In contrast, iron poisoning occurs after an overdose and symptoms appear in stages. It begins with gastrointestinal symptoms such as vomiting, bloody vomiting, diarrhea and abdominal pain. Down to more severe symptoms such as rapid heartbeat, hypotension, failure, cirrhosis of the liver, stomach obstruction, coma and death in advanced stages. Children have the worst forms of iron toxicity and are usually more susceptible to it [8].
Cadmium has no known biological functions and it is non-degradable and therefore builds up in the food chains. toxicity problems by this mineral can appear even at low concentrations [9]. Cadmium poisoning causes harmful effects on the cardiovascular and immune system and the kidneys. It also prevents the metabolism of calcium and vitamin D, thus causing osteoporosis, also can cause hemolysis and is considered a carcinogen [10].
Due to the importance of iron and its widespread use in agricultural and industrial activities, and the danger of cadmium and its harmful effects, especially on children, the proportion of these two elements was estimated in this study.

MATERIALS AND METHODS

Samples

Each chip sample was purchased from several markets in (Elajelat, sabratha) Libya.

Instruments

Flame and graphite furnace atomic absorption spectrophotometry thermo GF95), Germany.

Determination of mineral contents

Collected chips samples were dried at 70 ºC in a drying cabinet with air-circulation until they reached constant weight. Later, about 0.5 g dried and ground sample was digested by using 5ml of 65% HNO3 and 2 ml of 35% H2O2 in a closed microwave system at 200 ˚C. The volumes of the digested samples were completed to 20 ml with ultra-deionized water and mineral concentrations were determined by inductively flame and graphite furnace atomic absorption spectrophotometry (thermo GF95) Germany. Distilled deionized water and ultrahigh-purity commercial acids were used to prepare all reagents, standards, and samples. After digestion treatment, samples were filtrated through Whatman No 42. The filtrates were collected in 50 ml flasks and analyzed by inductively Flame and graphite furnace atomic absorption spectrophotometry (thermo GF95) Germany.
The mineral contents of the samples were quantified against standard solutions of known concentrations which were analyzed concurrently [11].

Statistical analyses

Results of the research were analyzed for statistical significance by analysis of variance using SPSS software version 22.

RESULTS AND DISCUSSION

The results showed presence of heavy metals (fe, cd) in different concentration in all samples. Concentrations was shown in table (1) and table (2).
Table (1) shows the cadmium concentration in potato chips sample under study. Cadmium concentration ranged from 0.2950 mg/l to 1.8300 mg/l, where the highest concentration was in Lorenz (sour cream) and lowest concentration was in Pringles (bursting flavour) as we note. According to the Syrian Arab specifications and standards 2002 which also recommended by the Libyan national center for standardization the permissible level of cadmium is 0.05 mg/l., and all samples under study was above this level.
In case of iron, concentrations ranged from 17.5767 mg/l to 32.1390 mg/l. Where the highest concentration was in crisp the world (paris style), and lowest concentration was in B&C (Mr. crunch nacho cheese) as shown in table (2). It is worth noting that iron toxicity occurs when iron is taken at a dose of 20-60 mg / kg, which results in moderate symptoms. More than this dose results in severe toxicity and death, and less than this dose is considered non-toxic [12]. The results of this study were different from the results in the Jordan study that shows lower level of some heavy metals in their samples [13]. The high percentage of heavy metals in our samples could be due to the weak control over some imported products.

Table 1. Content of (Cd) in the samples of potato chips

Name of sample	Conc.(mg/I)	Average	std	C.V
1. Crisp the world (rio de janeiro style)	0.4330 0.4250 0.4340	0.4307	0.0049	**1.1454**
2. Pringles (bursting flavor)	0.2550 0.3100 0.3200	0.2950	0.0350	**11.8644**
3. Lorenz (sour cream)	0.7040 0.6600 0.6300	1.8300	0.0372	**2.0339**
4. B&C (Mr. crunch nacho cheese)	0.3250 0.3300 0.3400	0.3317	0.0076	**2.3028**
5. Rock (seasoned cheese)	0.6510 0.6600 0.6400	0.6503	0.0100	**1.5402**
6. Lays (edible salt)	0.8100 0.8500 0.5300	0.7300	0.1744	**23.8844**
7. Crisp the world (paris style)	0.5560 0.5420 0.5220	0.5400	0.0171	**3.1644**
8. Chipsy (salt)	0.9010 0.8640 0.8520	0.8723	0.0255	**2.9279**
9. Top chipsy (ketchup)	0.5660 0.6020 0.5730	0.5803	0.0191	**2.1881**
10. Crisp up (cheese)	0.7140 0.7080 0.7050	0.7090	0.0046	**0.6463**
11. Lorenz pomsticks (cheese)	0.2880 0.3110 0.3150	0.3047	0.0146	**4.7828**
12. Crisp the world (Jalisco style)	0.4510 0.4600 0.4550	0.4553	0.0045	**0.9903**

Table 2. Content of (fe) in the samples of potato chips.

Name of sample	Conc.(mg/I)	Average	Std	C.V
1. Crisp the world (rio de janeiro style)	18.3300 18.2560 18.2410	18.2757	0.0476	**0.2607**
2. Pringles (bursting flavor)	20.4400 20.4700 20.9100	20.6067	0.2631	**1.2769**
3. Lorenz (sour cream)	22.1700 22.2300 22.1990	22.1997	0.0300	**0.1352**
4. B&C (Mr. crunch nacho cheese)	17.5800 17.5600 17.5900	17.5767	0.0153	**0.0869**

5. Rock (seasoned cheese)	30.0810 30.1200 30.1500	30.1170	0.0346	**0.1149**
6. Lays (edible salt)	28.4140 28.4200 28.3800	28.4047	0.0216	**0.0759**
7. Crisp the world (paris style)	32.1400 32.1550 32.1220	32.1390	0.0165	**0.0514**
8. Chipsy (salt)	25.4540 25.5000 25.4080	25.4540	0.0460	**0.1807**
9. Top chipsy (ketchup)	23.0970 23.1330 23.0700	23.1000	0.0316	**0.1368**
10. Crisp up (cheese)	21.1900 21.2300 21.1710	21.1970	0.0301	**0.1421**
11. Lorenz pomsticks (cheese)	27.5500 27.6500 27.6500	27.6167	0.0577	**0.2091**
12. Crisp the world (Jalisco style)	22.1300 22.1600 22.1440	22.1447	0.0150	**0.0678**

CONCLUSION

From this study, we concluded that all samples contained heavy metals in different concentrations. Some of these metals are present in high concentration especially cadmium, which have a negative effect on health due to its carcinogenicity. Moreover, iron was presented in high concentrations which may cause health disorders from moderate to severe depending on the amount of this increase. We recommend that people at risk of exposure to toxic metals ensure their regular consumption of vegetables and fruits rich in beneficial vitamins and minerals such as calcium, zinc and vitamin C, which act as natural anti-heavy metal toxicities. In addition to preventing the consumption of these products containing these heavy metals especially by Children and replace them with healthier foods to ensure their proper growth and maintain their health.

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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