Iraqi Journal of Science
ISSN: 0067-2904
GIF: 0.851

Detection of some heavy metals and bacterial contamination in canned vegetables

Hussein K. Noaman* , Ithar K. Al-Mayaly

Department of Biology, College of Science, University of Baghdad, Baghdad,Iraq.

Abstract

In this paper, thirty six samples of canned vegetables were collected randomly from different markets in Baghdad city from October 2013 till March 2014. The study includes identifying the concentration of some heavy metals (lead, nickel, zinc and iron) by flameless atomic absorption spectrophotometery. It was found that the higher concentrations of heavy metals in canned vegetables, was lead 1.179 ppm in olive, nickel 0.9078 ppm in olive, while zinc 10.143 ppm green peas and iron 90.601ppm in white asparagus; but the lower concentrations represents with lead 0.0021 ppm in green asparagus, nickel 0.0202 ppm in mushroom, while zinc 0.528 ppm in white asparagus and iron 4.061 ppm in green peas. Canned food has been reported to be contaminated mainly by spores forming bacteria of the genera *Bacillus* main sources of a meal. The bacteria that reported in this study were *bacillus* spp.

Keywords: Canned vegetables, heavy metals, bacterial contamination.

التحري عن بعض العناصر الثقيلة والتلوث البكتري في الخضروات المعلبة

حسين خالد نعمان* ، ايثار كامل الميالي

قسم علوم الحياة، كلية العلوم، جامعة بغداد، بغداد، العراق.

الخلاصة

تم في هذا البحث، اخذ ستة وثلاثين عينة من الخضروات المعلبة وتجميعها من اسواق مختلفة في مدينة بغداد بشكل عشوائي خلال الفترة من شهر تشرين الاول ٢٠١٣ لغاية شهر اذار ٢٠١٤، حيث تضمنت الدراسة التحري عن تراكير بعض العناصر الثقيلة وهي (الرصاص و النيكل و الخارصين و الحديد) بوساطة جهاز

*Email: Hussen_bio@yahoo.com

الامتصاص الذري، وكانت التراكيز العالية التي تم تسجيلها في الخضروات المعلبة قد تمثلت، الرصاص (1.179 ppm) في الزيتون، النيكل (0.9078ppm) في الزيتون، بينما الخارصين (10.143 ppm) في البزاليا الخضراء والحديد سجل (90.601 ppm) في الهليون الابيض. اما التراكيز القليلة فقد تم تسجيلها في العينات كالاتي، الرصاص سجل (0.0021 ppm) في الهليون الاخضر، النيكل (0.0202 ppm) في الفطر، بينما كان الخارصين (0.528 ppm) في الهليون الابيض و الحديد كان (4.016) ppm في البزاليا الخضراء. الاغذية المعلبة عادة تكون ملوثة بالبكتريا من جنس .*bacillus* spp والتي تم عزلها في هذه الدراسة.

Introduction:

Contamination of foods by heavy metals has become an in evitable challenge these days. Air, soil, and water pollution are contributing to the presence of harmful elements, such as cadmium, lead, and mercury in foodstuff. [1]. Certain vegetables take up heavy metals from contaminated water used for irrigation, in many countries; sewage and wastewater from industry are used for irrigating farmland [2]. Vegetables can absorb metals from soil as well as from deposits on the parts of the vegetables exposed to the air from polluted environments [3]. This practice has two purposes: it disposes of wastewater and adds nutrients and organic matter to soils. However, there is concern about harmful pollutants in wastewater entering the food chain. If consumed in high concentrations, heavy metals can deplete important nutrients and lead to serious health problems [2]. Heavy metals are non-biodegradable and persistent environmental contaminants which may be deposited on the surfaces and then adsorbed into the tissue of the vegetables. [4]. A risk of contamination of the food chain may arise when heavy metals accumulate in plant tissue at threaten the health of human or animal feeding on the same crops [5]. The metals can be classified as potentially toxic like, lead and probably essential like, nickel, and essential like, zinc [6]. Canned foods are packed in hermetically sealed containers and are commercially sterile [7]. Canned food has been reported to be contaminated mainly by spores forming bacteria of the genera *Bacillus* and *clostridium* main sources of a meal. Bach plant species has its nutritive requirements differing from other. Thus different plants supported by identical solution will contain varying concentration of minor and macro elements [8].

The aim of the study was to determination the concentration of some heavy metals (lead, nickel, zinc and iron) which can be found in some canned vegetables that may found in some Iraqi markets.

Materials and methods:

Apparatus

All glassware that used was soaked by acid and rinsed with distilled water and dried before using. Flameless Atomic absorption spectrophotometer (Novaa, German) was used for the determination of heavy metals, while in bacteria we used nutrient agar for isolation and then we used differential testes to recognize species of *bacillus*.

Digestion

For the determination of selected heavy metals, about 5 ± 0.01g of homogenized sample were weighed into a 200ml beaker and 5ml of concentrated HNO_3 were added. The beaker was covered with a watch glass, and after most of the sample was dissolved by standing overnight, it was heated on hot plate with boiling until any vigorous reaction had subsided. Leaf the solution to cool then transferred into a 25ml volumetric flask and diluted to the mark with distilled water [9].

In this study, thirty six samples of canned vegetables were collected randomly from different markets of Baghdad city from October 2013 till March 2014 in three replicates.

Results and discussion:

The comparison between all examined canned samples for Pb content shows that olive samples had highest (0.552 ± 0.033 ppm) content in October but in November white asparagus had (0.405 ± 0.107 ppm) the highest mean value while in December and January; peas gave the highest mean value (0.923 ± 0.388 and 0.850 ± 0.138 ppm respectively) . In February, olive sample was found to have the highest mean value (1.077 ± 0.088 ppm) while in March both peas (0.487 ± 0.219 ppm) and olive samples (0.491 ± 0.038 ppm) had the highest mean values (Figure- 1). According to previous studies done by, [11] reported the concentration of lead 0.25- 4.56 mg/kg, another study by [12] reported the concentration of lead 0.010- 0.285 mg/kg.

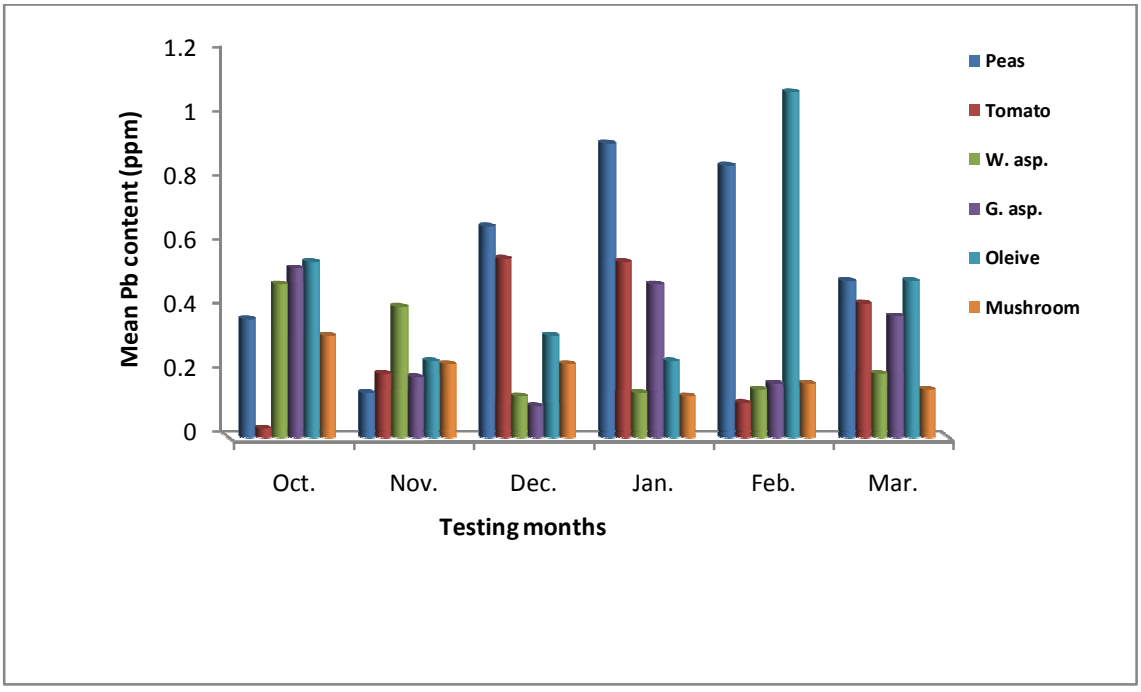

Figure 1- Mean lead content (ppm) in canned peas,tomato, white & green asparagus, olive and mushroom samples examined during study periods.

When comparing between all canned samples in period of study for Ni, it was that in October and November, 2013 green peas recorded highest values 0.383 ± 0.045, 1.000 ± 0.077 ppm respectively, while in December 2013 white asparagus had highest value 0.410 ± 0.025 ppm, green peas reported high value in January 2014, 0.774 ± 0.105 ppm, whereas in February 2014 peeled tomato had 0.392 ± 0.052

ppm which is highest value, finally, olive had highest value 0.452 ± 0.073 ppm, (Figure- 2). A study by [10] on vegetables who reported value of nickel 0.21- 3.54 mg/kg, another study by [12] on fruit juices, who reported concentration of nickel 0.04- 2.4 ppm.

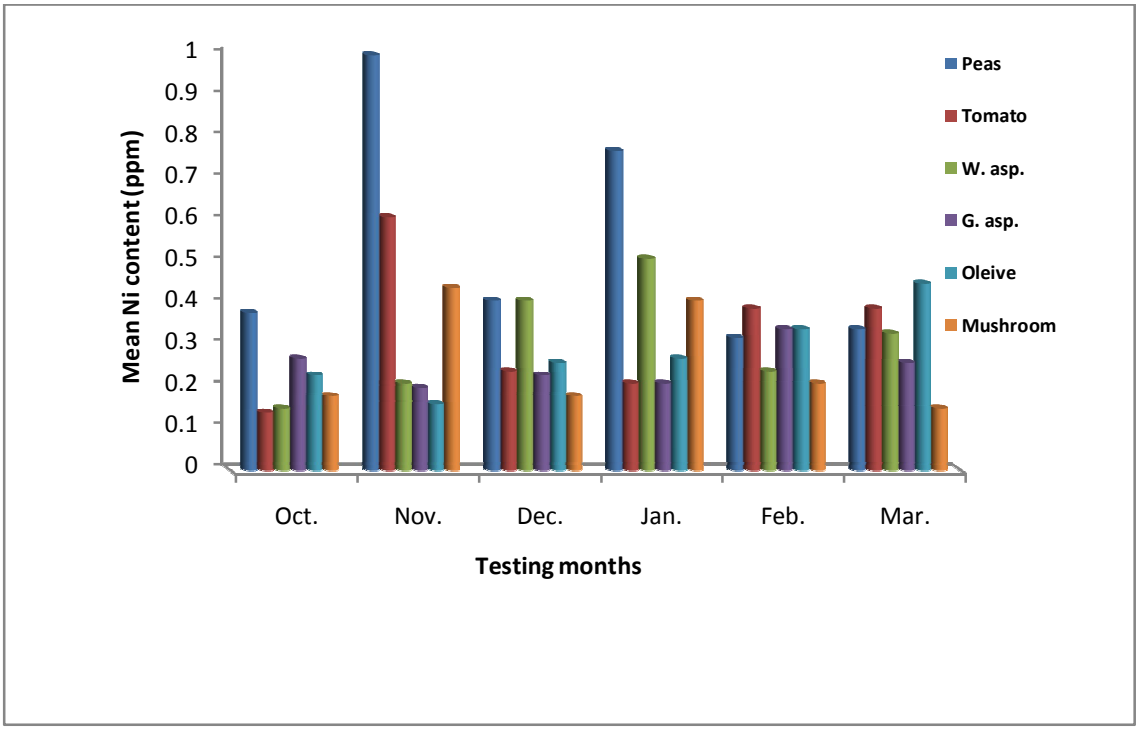

Figure 2- Mean Nickel content (ppm) in canned peas,tomato, white & green asparagus, olive and mushroom samples examined during study periods.

The (Figure-3) appear the highest values of zinc of all examined canned samples, in October 2013, November 2013, January 2014 and February 2014 green peas had highest value 7.945 ± 0.664, 8.250 ± 0.486, 7.010 ± 1.046, 9.719 ± 0.299 ppm, respectively, while in December 2013 olive had highest value 3.185 ± 0.418 ppm, finally in March mushroom had highest value 8.558 ± 0.109 ppm. The results of zinc agreement with [13] in tomato reported that mean of zinc 2.92 µg/g dw, also [11] reported the concentration of zinc 0.0526- 1.5472 mg/kg. [14] study on canned fruits reported the concentration of iron 2.29- 18.29 ppm.

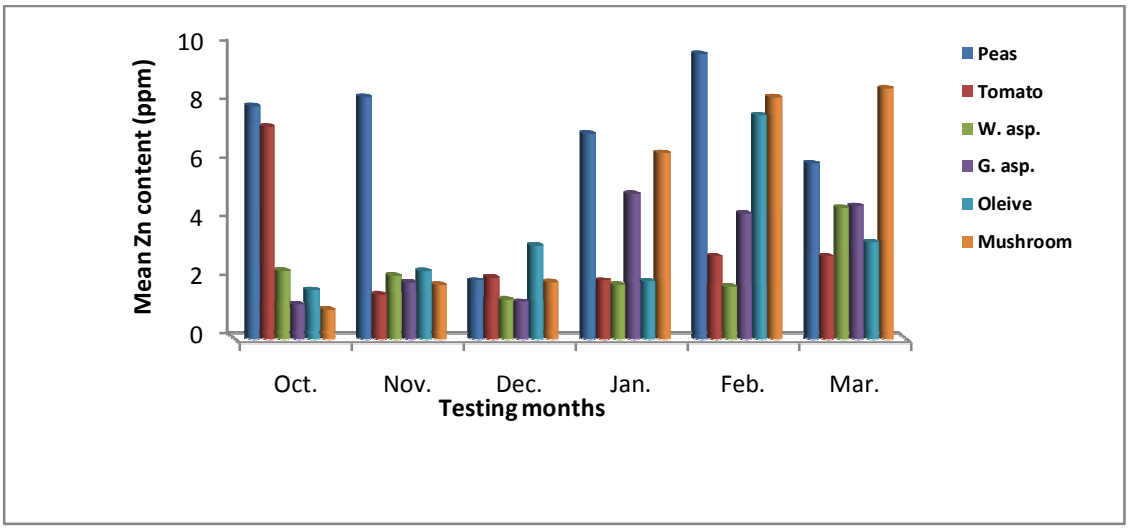

Figure 3- Mean Zinc content (ppm) in canned peas,tomato, white & green asparagus, olive and mushroom samples examined during study periods

Iron appear in high concentration in most samples because its appear in high amounts in earth crust, the highest values of iron appear in (Figure-4), white asparagus had highest values in October 2013, November 2013, December 2013 and February 2014, 66.292 ± 6.784, 91.287 ± 2.158, 39.410 ± 2.961, 41.133 ± 2.320 ppm respectively, whereas olive had highest values in January and March 2014, 78.358 ± 3.536, 54.704 ± 8.575 ppm, respectively, a ranged similar study by [13], reported that concentration of iron 32.25- 64.53 µg/g dw.

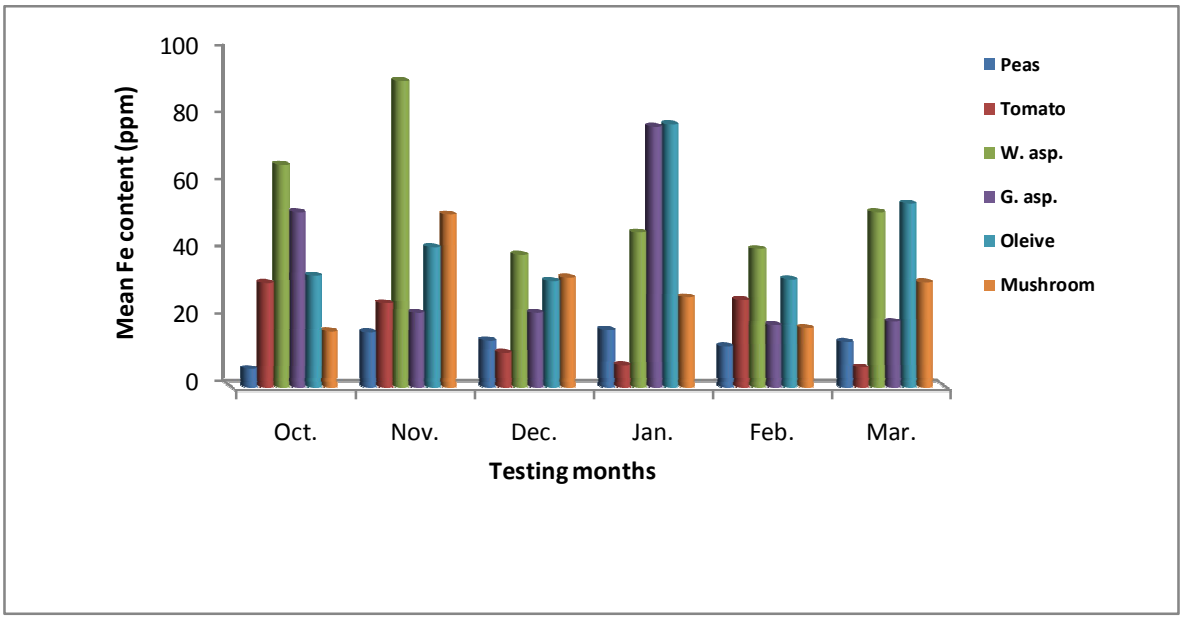

Figure 4- Mean Fe content (ppm) in canned peas,tomato, white & green asparagus, olive and mushroom samples examined during study periods.

However disagreement study by [13] on vegetables, who mention range of lead 4.31- 5.51 and nickel 1.02- 11.64 µg /g dw, another study by [15] on vegetables, who mention value of iron 1.67 µg /g.

The results of bacteria in canned vegetables, all examined samples had shows negative growth except in some samples that given in table (1), the bacteria that found was *Bacillus cereus* in almost of isolates. These results were agreement with [12] and don't agree with [16] and [17]. We used some identification testes includes observed under microscope oil immersion lens (100x), its appear as gram positive, spore forming, motile and rod shape bacteria, other testes includes motility test, citrate test.

Table 1- Bacterial growth in canned vegetables samples

Canned stuff	Month	Mean Bacterial growth± SD	
		Aerobic	An aerobic
green asparagus	Dec. 2013	32.6± 6.23	0.0
Olive	Dec. 3013	40.6± 5.5	0.0
Mushroom	Dec. 2013	36± 6.48	0.0

References:

1. Zukowska, J. and Biziuk, M. **2008**. Methodological evaluation of method for dietary heavy metal intake. *Journal Food Science*, 73(2), pp:21-29.
2. Stasinos, S. and Zabetakis, I. **2013**. The uptake of nickel and chromium from irrigation water by potatoes, carrots and onions. *Ecotoxicology and Environmental Safety*. European commission. 91, pp:122-128.
3. Haiyan, W. and Stuanes, A.O. **2003**. Heavy metal pollution in air water- soil-plant system of zhuzhou city, human province, *China Water,Air and Soil Pollution*. 147, pp: 79-107.
4. Singh, A.; Sharma R. K.; M. Agrawal, and F.M. Marshall. **2010**. Risk assessment of heavy metals toxicity through contaminated vegetables from waste water irrigated area of Varanasi, *India, Tropical Ecology*. 51, pp: 375-387.
5. Mantovi, P.; Bonazzi, G.; Maestri, E. and Marmiroli, N. **2003**. Accumulation of copper and zinc from liquid manure in agricultural soils and crop plants. *Plant and Soil*, 250(2), pp: 249-257.
6. Anon, **1986**. ICMSF. (International Commission on Microbiological Specifications for Foods). Microorganisms in food 2. Sampling for microbiological analysis. Principles and specific application. Blackwell Scientific Publication.

7. Ihekeronye, A.I. and P.O. Ngoddy, **1985**. *Intergral food science and technology for the Tropics*. Macmillian Education Ltd. Oxford and Londod, p, 293.
8. AOAC. **2003**. Official Method 999.10.Lead, cadmium, zinc, copper and iron in foods, atomicabsorption spectrophotometry after microwave digestion, first action 1999, NMKL-AOAC method.
9. Akan, J.C.; Kolo, B.G.; Yikala, B.S. and Ogugbuaja, V.O. **2013**. Determination of Some Heavy Metals in Vegetable Samples from Biu Local Government Area, Borno State, North Eastern Nigeria. *International Journal of Environmental Monitoring and Analysis*; 1(2), pp: 40-46.
10. Dallatu, Y. A.; Abechi S. E.; Abba H.; Mahammod,U. S. and Ona E. C. **2013**. Level of heavy metals in fresh and canned foods consumed in North Central Nigeria. *Scholarly Journal of Agricultural Sciences*. 3(6), pp: 210-213.
11. AL-Mayaly, I. K. **2013**. Determination of some heavy metals in some artificial fruit juices in iraqi local markets. *International Journal of Research and Development in Pharmacy and Life Science*. Vol. 2: p: 507-510.
12. Osma, E.; Ozyigit, I.I.; Leblebici, Z.; Demir, G. and Serin, M. **2012**. Determination of heavy metal concentrations in tomato (*Lycopersicon esculentum* Miller) Grown in different station types. *Romanian Biotechnological Letters*. University of Bucharest. 17(1) pp: 6962-6974.
13. Chukwujindu, M.A.; Nwozo S.O.; Ossai E.K.; and Nwajei G.E. **2008**. Heavy metals composition of some imported canned fruit drinks in Nigeria. *American Journal of Food Technology*, 3, pp: 220-223.
14. Edem, C.A.; Dosunmu, M.I. and Bassey, F. I. **2009**. Distribution of heavy metals in leave, steams and root of fluted pumpkin (*Telfeiria occidentalis*). *Pakistan journal of nutrition* 8(3): 222-224.
15. Ali, N.H.; Farooqui, A.; Khan, A.; Khan, A.Y. and Kazmi, S.U. **2010**. Microbial contamination of raw meat and its environment in retail shops in Karachi, Pakistan. Department of Microbiology, University of Karachi, Karachi, *Pakistan*. *J Infect Dev Ctries*; 4(6):382-388.
16. Najim, L.H. **2014**. Investigation of bacterial contamination and some heavy metals in imported canned meat in Baghdad. M. Sc. Thesis, University of Baghdad, Collage of Science, Baghdad, Iraq.