# MONITORING OF SOME HEAVY METAL LEVELS IN VEGETABLES AND FRUITS FROM LOCAL MARKET BASSIOUN DISTRICT, GOVERNORATE EL- GHARBIA, EGYPT

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***Abstract***

The aim of this study was to determine the levels of heavy metals Zinc(Zn) , Cadmium (Cd), Lead (Pb), Manganese (Mn) and Chromium (Cr) in different edible vegetables and fruits samples collected from the market of Bassioun district , EL – Gharbia Governorate , Egypt. Mineral contents were analyzed using Microwave Plasma – Atomic Emmission Spectroscopy.

The obtained results revealed that heavy metals of Zinc was below the permissible limits according WHO / FAO in vegetables samples and values ranged between 2. 112 – 10.825 mg / kg but it ranged between 1.47 – 6.012 mg / kg in fruit samples .Concentrations of Cd were also below the permissible limits as mentioned with WHO/ FAO in most vegetables and fruits samples except for Potato (0.1 mg / kg) , Pear (0. 1 25 mg / kg) , Orange ( 0. 1 37 mg / kg ) and Zaghlol dates (0.225 mg / kg). According to the results, Zn concentration in vegetables and fruits were equal and above the permissible limits according WHO / FAO limits. Concentrations of Pb was lower than the permissible limit WHO / FAO in most vegetables and fruit samples except of Green beans (0 .787 mg / kg), Onion ( 0. 337 mg / kg) , Potato (0. 775 mg / kg) , Guava ( 0. 625 mg / kg) showing above the WHO / FAO (2001). Concentrations of Mn in vegetable and fruit samples was lower than the permissible level set by the WHO / FAO which ranged between 0. 77 mg / kg – 4. 72 mg / kg ) in vegetable samples and 0.82 – 4.37 mg / kg in fruit samples respectively . Finally concentrations of Cr was higher than the permissible limits according WHO / FAO in all vegetable and fruit samples which ranged between 0. 212 mg / kg – 0 . 962 mg / kg in vegetable and 0.475 mg / kg – 0. 787 mg / kg in fruit samples.

**Keywords:** heavy metal, vegetables, fruits, Plasma-Atomic emmission spectroscopy

## INTRODUCTION

Fruits and vegetables are rich sources of vitamins, minerals, and fibers and also have beneficial antioxidative effects. However, the intake of heavy metal contaminated fruit and vegetables may pose a risk to human health; hence the heavy metal contamination of food is one of the most important aspects of food quality assurance Radwan and Salama (2006) and Khan *et al*., (2008). Plants take up heavy metals by absorbing them from airborne deposits on the parts of the plants exposed to the air from the polluted environments as well from contaminated soils through

root systems . Also, the heavy metal contamination of fruit and vegetables may occur due to their irrigation with contaminated water .

Heavy metals are very toxic in elemental and soluble salt forms . Their presence in the atmosphere, soil and water even in trace can cause serious problems to organism. Heavy metals are harmful because of their non-biodegradable nature , long biological half live and their capacity to accumulate in different parts of plants. Even at low concentration, they show damaging effects to human and animals because there is no mechanism for their elimination from the body Wang and wang (2005) ; Singh *et al.*, (2001).

Pollution of vegetables with heavy metal may come from irrigation with polluted water , the apposition of fertilizers and metal – based pesticides , polymeric emissions , transportation , the harvesting operation , storage and or at the point of selling .

The objectives of this study were determine the concentration of five heavy metals, that is , Zinc , Cadmium, Lead, Manganese and Chromium in different edible vegetables and fruits samples of market Bassioun district , Governorate EL- Gharbia , Egypt.

## MATERIAL AND METHODS

**Sample preparation and treatment**

Samples of vegetables and fruits aggregated from the market Bassioun district, Governorate El- Gharbia , Egypt through October month 2015 .

Fresh samples of vegetables and fruits were air dried for seven days slight modification it putting the samples on temperature room for 7 days instead of exposing air dried and then oven dried at 45 c° to constant weight . They were ground with porcelain mortar and piston to fine particle size and stored in plastic containers for analysis . In mineral determination these Zn , Cd , Pb , Mn and Cr determined by micro wave plasma – Atomic emission spectroscopy by wet digestion .

**Digestion of of vegetables and fruit Samples for heavy metal determination**

Wet digestion :0.5 gm of dried sample was added with 5 ml conc. $HNO_3$ and placed on the hot plate for 1 h and getting half dried , again 5 ml conc . $HNO_3$ and 2 ml of $H_2O_2$ was added and again kept on hot plate for 1 h and after getting half dried cooled and filtered with the help of wattman filter paper and volume of the residue was made up to 25 ml with 2 $NHNO_3$ and taken to the Atomic absorption spectro photometer for above mentioned minerals analysis by using Aluka standards (AOAC , 1990) . with slight modificiation which analysis by micro wave plasma Atomic emission spectroscopy.

## RESULTS AND DISCUSSION

Contamination of fruit and vegetables crops (as an important part of people،s diet) with heavy metals is a health concern, therefore ,monitoring levels of heavy metals in fruit and vegetables can provide useful information for promoting food safety

Data in Tables (1) , showed that , element Zn in vegetable samples from the market Bassioun district was lower than the permissible limits according to WHO / FAO (2001) which the values of Zn detected was 2.11 mg / kg in Eggplant ,2.33 mg/ kg in Potato ,2.58 mg / kg in Bell pepper , 5.33 mg / kg in Onion , 5.41 mg / kg in Green beans , 7.26 mg / kg in Marrow , 9.8 mg / kg in Cucumber and 10.82 mg/ kg in Okra respectively .

Element Cd in Table (1) was not detected in some vegetables from the market Bassioun district such as Tomato , Green beans , Marrow , Okra and Cucumber while the values of Cd detected was lower than the permissible limits according WHO / FAO (2001) which the values of Cd was 0.025 mg/kg in Onion , 0.0375 mg / kg in Eggplant , 0.062 mg / kg in Garlic and 0.087 mg/ kg in Bell pepper respectively . While the value of Cd in Potato was 0.1 mg /kg equal the permissible limits according WHO / FAO (2001). Table (1) showed that the values of Pb was not detected in some vegetables from the market Bassioun district such as Tomato , Marrow , Okra , Cucumber and Eggplant while the values of Pb was lower than the permissible limits according to WHO / FAO (2001 ) which was 0.1 mg / kg and 0.2 / mg / kg in Garlic and Bell pepper while was 0.33 , 0.77 and 0.78 / mg / kg in Onion , Potato and Green beans .

Element Mn in table (1) was lower the permissible limits in all vegetable samples which were 0.775 , 0. 95 , 1.2 , 1.8 , 1.81 , 2.85 , 2.85 , 2.85 , 3.8 , 4.8 , and 4.72 in Eggplant , Potato , Garlic , Bell pepper , Onion , Okra , Tomato , Cucumber , Green beans and Marrow respectively .

Also values element Cr in Table (1) was higher than permissible limits according WHO / FAO (2001) in all vegetable samples except Eggplant (0.21 mg / kg ) which was lower the permissible limit according WHO / FAO (2001) . Data in Table (2) indicated the amounts of detected heavy metals in fruits samples collected from the market Bassiuon district , Governorate El – Gharbia , Egypt which the values of Zn in all fruits samples was lower the permissible limits according WHO / FAO (2001) which was 1.47 , 1.78 , 2.27 , 2.42 , 2.46 , 2.88 , 4 and 6.01 mg /kg in Grape , Guava , Orange , lemon , Banana , zaghlol dates , Samani dates and pear respectively. The value element Cd in Table (2) in most fruit samples was lower than the permissible limits

which was 0.0125 , 0.062 .0625 , 0.075 and 0.087 mg /kg in Guava ,Samani dates , Lemon , Grapes and Banana while was higher than the permissible limits 0.125 , 0.137 and 0.225 in Pear, Orange and Zaghlol dates respectively .

Table 1 . Mean concentration of heavy metals in vegetable samples (mg/kg) from the market Bassioun district 2015.

| Heavy metals / Sample name | Zn | Cd | Pb | Mn | Cr |
|---|---|---|---|---|---|
| Tamato | 5.437 | ND | ND | 2.85 | 0.775 |
| Green beans | 6.812 | ND | 0.787 | 4.387 | 0.737 |
| Marrow | 7.26 | ND | ND | 4.725 | 0.8 |
| Okra | 10.825 | ND | ND | 2.85 | 0.962 |
| Onion | 5.33 | 0.025 | 0.337 | 1.812 | 0.775 |
| Cucumber | 9.8 | ND | ND | 3.8 | 0.8 |
| Eggplant | 2.112 | 0.0375 | ND | 0.775 | 0.2125 |
| Potato | 2.337 | 0.1 | 0.775 | 0.95 | 0.787 |
| Garlic | 5.41 | 0.062 | 0.1 | 1.2 | 0.7 |
| Bell pepper | 2.587 | 0.0875 | 0.2 | 1.8 | 0.5 |
| WHO / FAO | 100 | 0.1 | 0.3 | 500 | 0.05 |

ND = not detected Values refer to Maximum Limit of World Health Organization (CODEX, 2001)

Table 2 . Mean concentration of heavy metals in fruit sample ( mg /kg ) from market Bassioun district 2015.

| Heavy metals / Sample name | Zn | Cd | Pb | Mn | Cr |
|---|---|---|---|---|---|
| Guava | 1.78 | 0.0125 | 0.625 | 1.062 | 0.475 |
| Samani dates | 4 | 0.062 | 0.15 | 1.225 | 0.65 |
| Romi Ahmar Grape | 1.475 | 0.075 | ND | 1.275 | 0.75 |
| pear | 6.0125 | 0.125 | 0.2 | 0.937 | 0.712 |
| lemon | 2.425 | 0.0625 | ND | 0.85 | 0.7125 |
| Orange | 2.27 | 0.1375 | 0.0875 | 0.825 | 0.625 |
| Banana | 2.462 | 0.087 | ND | 4.375 | 0.787 |
| zaghlol dates | 2.887 | 0.225 | 1.237 | 2.137 | 0.7125 |
| WHO / FAO | 100 | 0.1 | 0.3 | 500 | 0.05 |

ND = not detected Values refer to Maximum Limit of World Health Organization (CODEX, 2001)

In same table (2) the values of Pb detected was lower than the permissible limits according WHO / FAO in Orange , Samani dates and Pear while was higher of WHO/FAO which was 0.625 and 1.23 mg/kg in Guava and Zaghlol dates respectively . Concentrations of Mn in all vegetable and fruit samples was lower than the permissible limits according WHO/FAO (2001) which was in Eggplant 0.775 mg/kg ) ,Potato ( 0.95 mg/kg) , Garlic ( 1.2 mg /kg) , Bell pepper (1.8 mg/kg) , Onion (1.812 mg/kg) , Okra (2.85 mg /kg) , Tomato (2.85 mg/kg) , Cucumber (3.8 mg/kg) , Green beans ( 4.38 mg/kg) and Marrow (4.72 mg/kg) , in fruit samples were Orange (0.82 mg/kg) , Lemon( 0.85 mg /kg) , Pear ( 0.93 mg/kg) , Guava (1.062 mg/kg) , Samani

dates ( 1.23 mg/kg) , Grapes ( 1.27 mg/kg) , Zaghlol dates ( 2.137 mg /kg) and Banana ( 4.37 mg /kg) respectively .

Finally concentration of Cr in all vegetable and fruit samples were higher than the permissible limits according WHO/FAO (2001) which given values that Eggplant (0.212mg /kg) , Bell pepper ( 0.5 mg/kg) ,Garlic ( 0.7 mg/kg) , Green beans ( 0.73 mg/kg) , Onion ( 0.77 mg/kg) , Tomato (0.077 mg /kg) , Potato ( 0.78 mg/kg) , Cucumber (0.8 mg/kg) and Marrow ( 0.8 mg /kg) while given values in fruit samples that Guava ( 0.47 mg/kg) Orange ( 0.62 mg/kg) , Samani dates ( 0.65 mg /kg) , Grapes ( 0.712 mg/kg), Pear ( 0.712 mg /kg) , Lemon ( 0.712mg/kg) , Grapes (0.75 mg/kg) and Banana (0.78 mg/kg) respectively. These results agreed with those obtained by Radwan and Salama (2006) who found Cu, Zn, Pb and Cd of 2.17, 7.49, 0.87 and 0.02 mg/kg in strawberry and 1.83, 7.69, 0.26 and 0.01 mg /kg in tomatoes , respectively . Also,these results are in conformity with those of many researches as Mohamed et,al (2003) and Gebeloglu et,al 2004

## CONCLUSION

Monitoring of elements of Zn , Cd , Pb , Mn and Cr in vegetable and fruit samples from the market Bassiuon district , Governorate El- Gharbia , Egypt , showed that concentration of Zn and Mn in vegetable and fruit samples were lower than the permissible limits according WHO/FAO (2001) ,concentration of Cr in all vegetables and fruits samples was above the permissible limits, concentration element Cd was lower than of WHO/FAO (2001) in all vegetables samples while in fruit samples was lower than the permissible limits in Guava , Samani dates , Grapes , Lemon and Banana and higher than the permissible limits in Pear , Orange and Zaghlol dates .

Also concentration of element Pb was lower than permissible limits of WHO/FAO (2001) in most vegetable samples except for Green beans , Onions and Potato was higher than values of WHO/FAO (2001) while concentration of Cr was higher than the permissible limits of WHO/FAO (2001) in all fruits samples. Therefore , level of heavy metals is some of the analyzed vegetables and fruit samples was higher than the standard level. Considering the possible health outcomes due to the consumption of contaminated vegetables and fruits,it is reuired to take proper action for avoiding people،s chronic exposure .

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# رصد مستويات بعض العناصر الثقيلة في عينات الخضراوات والفاكهة في السوق المحلي لمركز بسيون – محافظة الغربية – مصر .

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*المعمل المركزي للمبيدات ، مركز البحوث الزراعية ، جيزه ، مصر .*

الهدف من البحث تقدير مستويات العناصر الثقيلة الزنك – الكادميوم – الرصاص – المنجنيز – الكروم في بعض عينات الخضروات والفاكهة المأخوذة من سوق مركز بسيون – محافظة الغربية – مصر وتم التقدير بواسطة جهاز Microwave Plasma- Atomic Emmisson Spectroscopy كانت النتائج كالاتي :. تركيزات عنصر الزنك كانت اقل من الحدود المسموح بها وفقاً ( لمنظمة الصحة العالمية / ومنظمة الاغذية والزراعة ) (٢٠٠١ ) في عينات الخضروات وكانت تتراوح بين ٢,١١٢ – ١٠,٨٢٥ ملجم / كجم وتتراوح بين ١,٤٧ –٦,٠١٢ ملجم/لكل كجم في عينات الفاكهة .تركيزات عنصر الكادميوم كانت اقل من الحدود المسموح بها وفقا ( لمنظمة الصحة العالمية / ومنظمة الاغذية والزراعة ) (٢٠٠١ ) في معظم عينات الخضروات والفاكهة ماعدا في عينة البطاطس ( ٠,١ ) ملجم / كجم – الكمثري ( ٠,١٢٥ ) ملجم / كجم وفي عينة البرتقال ( ٠,١٣٧ ) ملجم / كجم وفي عينة بلح الزغلول ( ٠,٢٢٥ ) ملجم / كجم كانت مساوية واعلي من الحدود المسموح بها وفقاً ( لمنظمة الصحة العالمية / ومنظمة الاغذية والزراعة ) (٢٠٠١ ) تركيزات عنصر الرصاص كانت اقل من الحدود المسموح بها وفقاً ( لمنظمة الصحة العالمية / ومنظمة الاغذية والزراعة ) (٢٠٠١ ) في معظم عينات الخضروات والفاكهة ما عدا الفاصوليا الخضراء ( ٠,٧٨٧ ) ملجم / كجم والبصل ( ٠,٣٣٧ ) ملجم / كجم والبطاطس (٠,٧٧٥) ملجم / كجم والجوافة ( ٠,٦٢٥ ) ملجم / كجم كانت اعلي من الحدود المسموح بها وفقاً ( لمنظمة الصحة العالمية / ومنظمة الاغذية والزراعة ) ( ٢٠٠١ ) . تركيزات عنصر المنجنيز في عينات الخضروات والفاكهة كانت أقل من الحدود المسموح بها وفقاً ( لمنظمة الصحة العالمية / ومنظمة الاغذية والزراعة ) (٢٠٠١ ) حيث تتراوح بين ( ٠,٧٧ ) ملجم / كجم – ( ٤,٧٢ ) ملجم / كجم في عينات الخضروات وتتراوح من ( ٠,٨٢ )– ( ٤,٣٧ ) ملجم / كجم في عينات الفاكهة علي الترتيب . اخيراً تركيزات عنصر الكروم كانت اعلي من الحدود المسموح بها وفقاً ( لمنظمة الصحة العالمية / ومنظمة الاغذية والزراعة ) (٢٠٠١ ) في كل عينات الخضروات والفاكهة حيث تتراوح بين ( ٠,٢١٢ ) ملجم / كجم – ( ٠,٩٦٢ ) ملجم / كجم في عينات الخضروات وتتراوح بين (٠,٤٧٢) ملجم / كجم – ( ٠,٧٨٧ ) ملجم / كجم في عينات الفاكهة