International Journal in Physical and Applied Sciences
Volume 07 Issue 5, May 2020 ISSN: 2394-5710 Impact Factor: 4.657
Journal Homepage: http://ijmr.net.in, Email: irjmss@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal

STUDY OF HEAVY METAL IN LIQUID CONFECTIONARY ITEMS

Dr.Jitender Pal and Sunder
Deptt of Environmental Science & Engineering, Guru Jambheshwar University of Science & Technology, Hisar- Haryana 125001

Abstract: - A major global concern of todays is heavy metals contamination in the environment, because of toxicity and threat to the human life & ecosystem. The concentration of heavy metals in water, air and soil are increasing day by day. The domestic and industrial sources contribute to increase in the concentration of heavy metals in environment.The study was conducted in order to analysis of heavy metals in packaged liquid items (Milk, Water, Juice, Soda, Cold drinks etc.). All liquid confectionary items of different brands and different batches were collected from local market of Hisar.To evaluate the health risk associated with consumption of heavy metal contaminated foods, HQ has been recognized as useful index. If HQ is greater than one (HQ>1), It can cause potential health risk. These results of tested liquid confectionary item tell about the possible lifelong carcinogenic and non-carcinogenic health hazard to peoples due to analysed consumption rate.

Keywords: - Heavy Metals, Atomic Absorption Spectrophotometer (AAS), Average Daily Dose (ADD)Hazard Quotient (HQ).

1.Introduction: -Heavy metals are of great disquiet as they are neither biodegradable nor thermally decomposable and persistent for a long life in human body through dietary intake or other exposure sources (Zhou H et al., 2016). Heavy metal contamination poses serious hazard to ecosystems and human health. These metals like cadmium, chromium, zinc, nickel, lead, copper, etc. causes serious threat in human health including neurological, liver damage, cancer, sensory disturbances, heart disease, cardiovascular diseases and central nervous system damage.Due to the poisonous nature, heavy metals cannot be degraded through biological, chemical or physical means to aharmless by-product(Adriana Dehelean et al,. 2013) By the process of oxidation or reduction, bioavailability and chemical nature of a heavy metal can be changed but the elemental nature of heavy metals remains the same because heavy metals are neither degradable nor thermally decomposable with the help of microorganism. As a result

heavy metal removal from water, air and soil is tedious job and they are always persisting in the ecosystem (Rubinaperveen, Shaistaismat et al, .2014).

Heavy metals such as Pb Cd, As have been recognized as the most toxic elements in the nature as well as in water and soil. Heavy metals such as Cd, Pb and As placed in priority pollutants list of United State Environment Protection Agency (Lei M et al., 2010). US Environment Protection Agency has placed Pb and Cd in group B2 that indicated said metals being possible human carcinogens. International Agency for Research on Cancer has categorized Cd compounds in Group 1 carcinogenic to human and inorganic Pb compounds in Group2A,Pb in Group 2B as probably carcinogenic to human and As has been placed in group A by United State Environment Protection Agency (EPA-540-R-070-002. 2009).

In India,urban food security is a matter of concern. It is estimated that by 2018, 65 % of India's population will be living in urban areas. The occurrence of heavy metals in human body always describe scientific disquiet as these are considered responsible for affecting health problems,

In urban areas, increasing trends of food contamination are largely credited to the polluted environment in urban agriculture, transportation of contaminated food, poor market sanitary conditions, and the use of polluted or waste water for irrigation purposes.The aim of this study is to measure the levels of heavy metal contamination in liquid confectionary items in local market of Hisar and to assess average daily dose of heavy metals in adults as well as children.

2.Material and Method

Present study was conducted to test the level of heavy metals concentration in selected packaged foods. Samples were collected from local market of Hisar. Hisar is located at 29005'N 75026'E/ 29.090N 75.430E in western Haryana.

2.1Samples Collection

Sixteen packaged foods of different brand were selected for the present study. All the selected packaged liquids (like milk, Water, Juice, Soda, Cold drinks) were collected from the local market of different brands and batches on random basis. Each of liquid samples we kept at a room temperature in PVC bottles for further use and analysis at 40 C.

2.2 Instruments used

The following instruments were used for the present study.

- Weighing balance
- Oven
- Distillation unit
- Atomic Absorption Spectrophotometer (AAS)
- Hot Plate

2.3 Digestion of samples

Take 1 ml of sample of each liquid item (in triplicate) were accurately weighed and placed in a flask. Add 10 ml of per hydrochloric and sulphuric acid (in 1:9 ratios). The pre-digested samples were put on the hot plate at 100◦ C till the all samples become the transparent in color. The samples were left cool and contents were filtered through Whatman filter paper no. 42. Each digested sample was making up to a final volume of 50 ml with distilled water and stored in PVC bottle for further analysis. All samples were prepared identically in triplicates. Blanks were prepared to check for background contamination by the reagent used.

2.4. Heavy Metal Analysis

Heavy metal (Pb, Cd, Cr, Cu, Zn and Ni) concentration in different packaged food wasdetermined by atomic absorption spectrophotometric method (APHA, 1998).

2.5 Health Risk Associated With Heavy Metals in Packaged foods

The health risk was assets using ADD and HQ. ADD for heavy metal referred to intake of that particular metal from all food groups and is an important indicator of health risk in the population exposure.

2.5.1 Average Daily Dose (ADD)

The quantity of heavy metals per kilogram of body weight per day

$$\boldsymbol{ADD = \frac{M_C \,.\, C_f \,.\, D_i}{B_W}}$$

Where, Mc is metal concentration in packaged foods (mg/kg)

D_i is daily intake of cereal (kg)

C_f is conversion factor consider one in all cases

B_w is body weight for adult (60kg)

Note:*Daily intakes of packaged foods were considered on the basis of survey conducted with 10 house wives and average daily intakes were found 50gms/person/day.*

2.5.2 Hazards Quotient (HQ)

Hazards Quotient (HQ) is the ratio of Average Daily Dose (ADD) to the reference dose (Rd) is defined as the maximum tolerable daily intake of a particular metal that does not result in any harmful effects. If the value of HQ < 1, the exposed population is safe and if HQ > 1, it indicates that there is a potential risk related to that metal and was calculated by equation:

$$HQ = \frac{ADD}{R_d}$$

Table 2.2 Reference dose (Rd) in mg/kg body weight per day

Heavy metal	Cd	Ni	Zn	Cr	Pb	Cu
Reference dose (Rd)	0.001	0.02	0.3	1.5	0.0035	0.04

Source: (US EPA IRIS 2010)

3.Results and Discussion

The study was conducted in order to analysis of heavy metals in packaged confectionary Liquid items (Milk, Water, Juice, Soda, Cold drinks etc.). All confectionary items of different brands and different batcheswere collected from local market of Hisar. The results of heavy metal in different brands of packaged confectionary are presented in Table.

3.1.1 Concentration of heavy metal in packagedsoft drinks.

All the three brands viz. Mango juice Guava Juice and Mix fruit Juiceare represented as B1, B2 and B3.Concentration of Chromium is lower in sample B1 (0.039 mg/kg) and highest in sample B2 (0.084) mg/kg. The level of Nickel was lower in sample B2 (0.019 mg/kg) and higher in sample B3 (0.045 mg/kg).

The level of Cadmium is highest in sample B1(0.092 mg/kg) and lowest in sample B2(0.019 mg/kg).Level of Lead was lowest in sample B1 (0.3 mg/kg) and highest in sample B2 (2.4 mg/kg) Concentration of copper was higher in sample B1 (0.33 mg/kg) and lowest in sample.

B2 (0.13 mg/kg) and Zinc level is higher in Packaged Fruit juice also maximum in sample B3 (2.71 mg/kg) and lowest in sample B1(1.08 mg/kg).

3.1.2 Concentration of heavy metal in packaged milk

All the three brands viz.packaged milk Powder, Full Cream of Gujarat Based company, Full Cream of Haryana based company samplerepresentedasG1, G2 and G3 respectively. Concentration of Chromium is lower in sample G2 (0.041 mg/kg) and highest in sample G3 (0.047) mg/kg. The level of Nickel was lower in sample G1 (0.09 mg/kg) and higher in sample G3 (0.11 mg/kg) .The level of Cadmium is highest in sample G3 (0.092 mg/kg) and lowest in sample G1 (0.12 mg/kg).Level of Lead was lowest in sample G2 (1.81 mg/kg) and highest in sample G1 (3.29mg/kg) Concentrationof copper was higher in sample G1 and G3 (0.005mg/kg) and lowest in sample G2 (0.004mg/kg) and Zinc level is higher in sample G3 (6.45 mg/kg) and found lowest in sample G1 (4.81mg/kg).

3.1.3 Concentration of heavy metal in packaged soda.

All the three brands of packaged soda are represented as K1, K2 and K3 respectively. Concentration of Chromium was lower in sample K1 (0.004mg/kg) and highest in sample K3 (0.008mg/kg). The level of Nickel was observed lower in sample K1 (0.018 mg/kg)
and higher in sample K3 (0.054mg/kg).

The level of Cadmium is highest in sample K3 (0.00084mg/kg) and lowest in sample K1 (0.00014mg/kg).Level of Lead was found lowest in sample K3 (0.96mg/kg) and highest in sample K1 (1.2 mg/kg). Concentration of copper was higher in sample K1 (0.099mg/kg) and lowest in sample K2 (0.057mg/kg) and Zinc level was maximum in sample K3 (4.35mg/kg) and lowest in sample K2 (4.01 mg/kg).

3.1.4 Concentration of heavy metal in packaged drinking water

All the three brands of packaged drinking water are represented as L1, L2 and L3 respectively. Level of Chromium was found lower in sample L2 (0.051mg/kg) and higher in sample L1 (0.11mg/kg). The level of Nickel was observed lower in sample L2 (0.027 mg/kg) and higher in sample L3 (0.16 mg/kg) .The level of Cadmium was found in small amount that is highest in sample L1 (0.005mg/kg) and lowest in sample L3 (0.004 mg/kg).Level of Lead was found lowest in sample L1 (0.21mg/kg) and highest in sample L3 (0.65mg/kg). Concentration of copper was higher in sample L2 (2.4 mg/kg) and lowest in sample L1 (1.3 mg/kg) and Zinc level was maximum in sample L2 (6.75mg/kg) and lowest in sample L3 (1.65mg/kg).

3.1.5 Concentration of heavy metal in cold drinks

All the three brands of cold drink are represented as N1, N2 and N3 respectively. Concentration of Chromium is lower in sample N1 (0.011mg/kg) and highest in sample N3 (0.026mg/kg).The level of Nickel was observed lower in sample N1 (0.007mg/kg) and higher in sample N2 (0.019 mg/kg).The level of Cadmium is highest in sample N3 (0.125mg/kg) and lowest in sample N1 (0.02 mg/kg).Level of Lead was found lowest in sample N1 (0.058mg/kg) and highest in sample N3 (0.298mg/kg). Concentration of copper was higher in sample N1 (0.218 mg/kg) and lowest in sample N3 (0.12mg/kg) and Zinc level was maximum in sample N1 (1.96mg/kg) and lowest in sample N3 (0.51mg/kg).

3.2 The average daily dose (ADD)

3.2.1. The average daily dose for packageditems in adults.

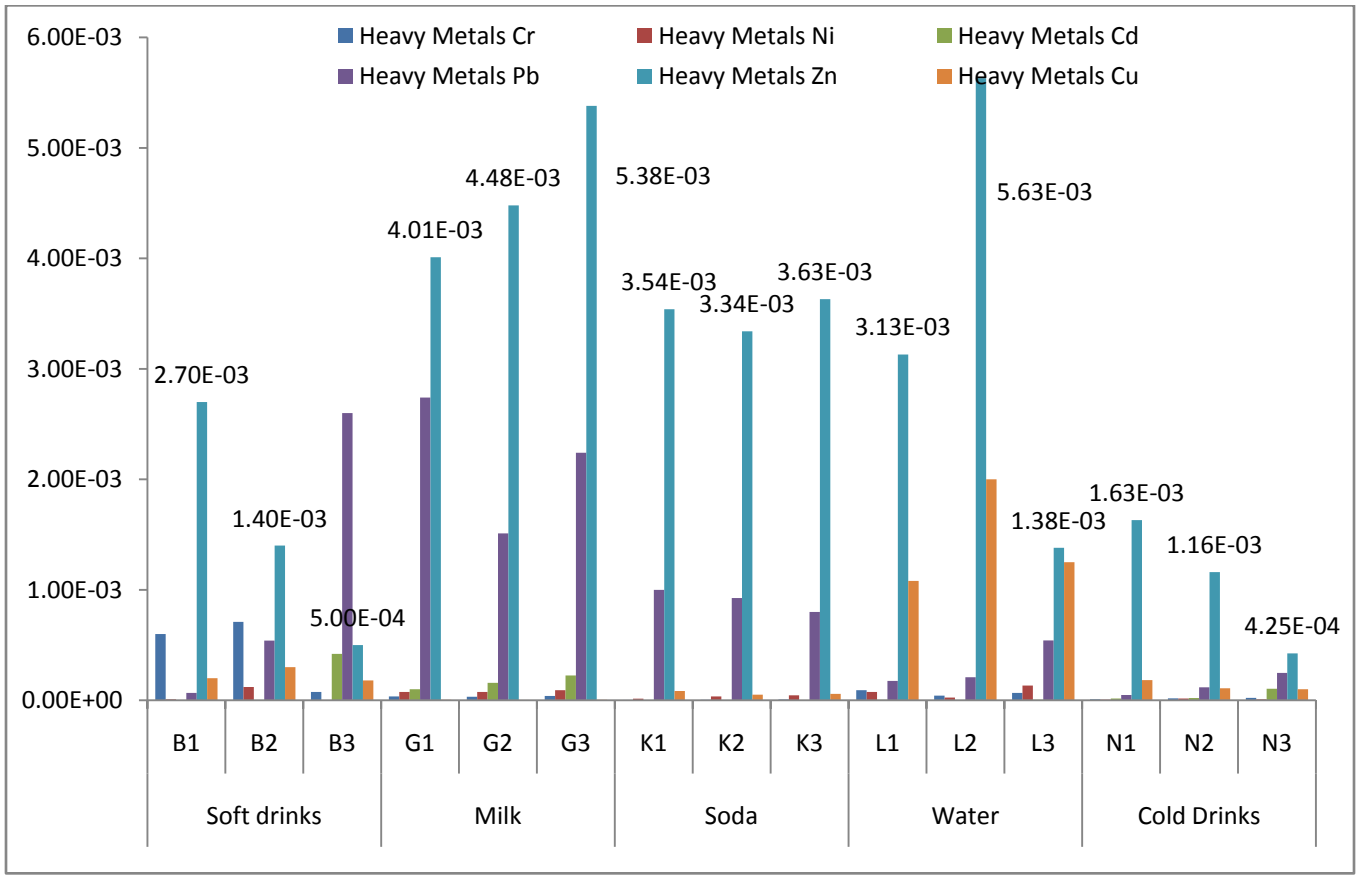

Fig 3.1:- Average Daily Dose in Adults

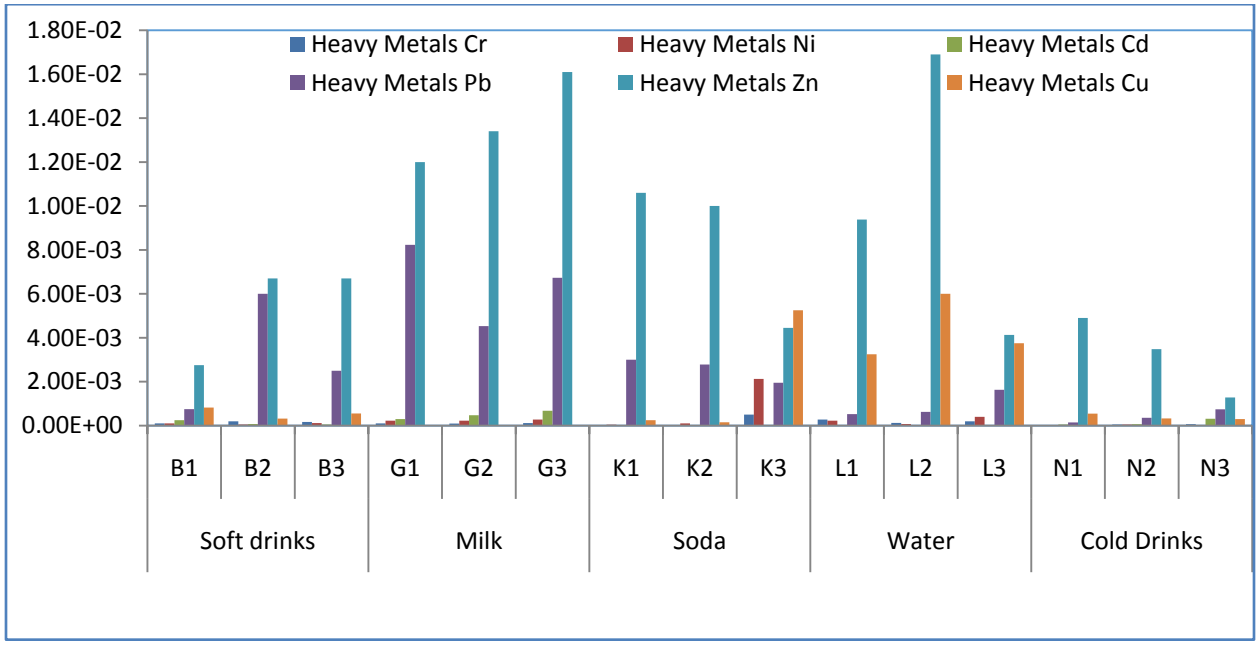

Fig 3.3:- Average Daily Dose in Children

4.3: Hazard quotient (HQ)

To evaluate the health risk associated with consumption of metal contaminated foods, HQ has been recognized as useful index. If HQ is less than one (HQ>1), the toxicant may produce adverse effect. With the increase in HQ value, the probability of experiencing long term carcinogenic effect increased. The HQ for consumption of selected confectionary items in adults and children are shown in Graph.

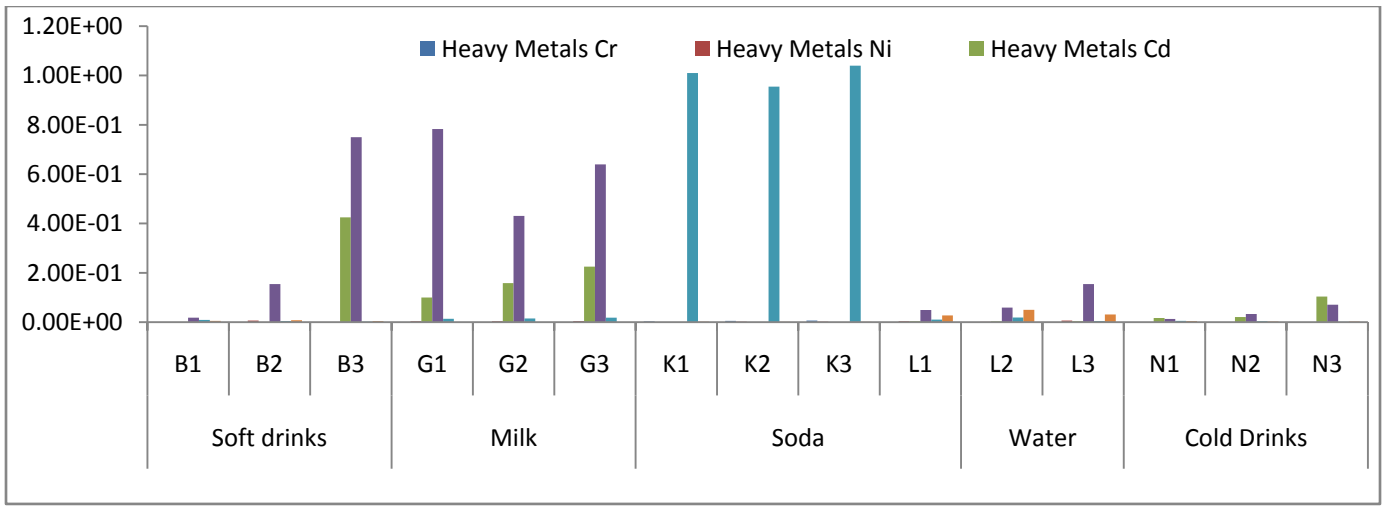

Figure 3.3: - HQ for Adults

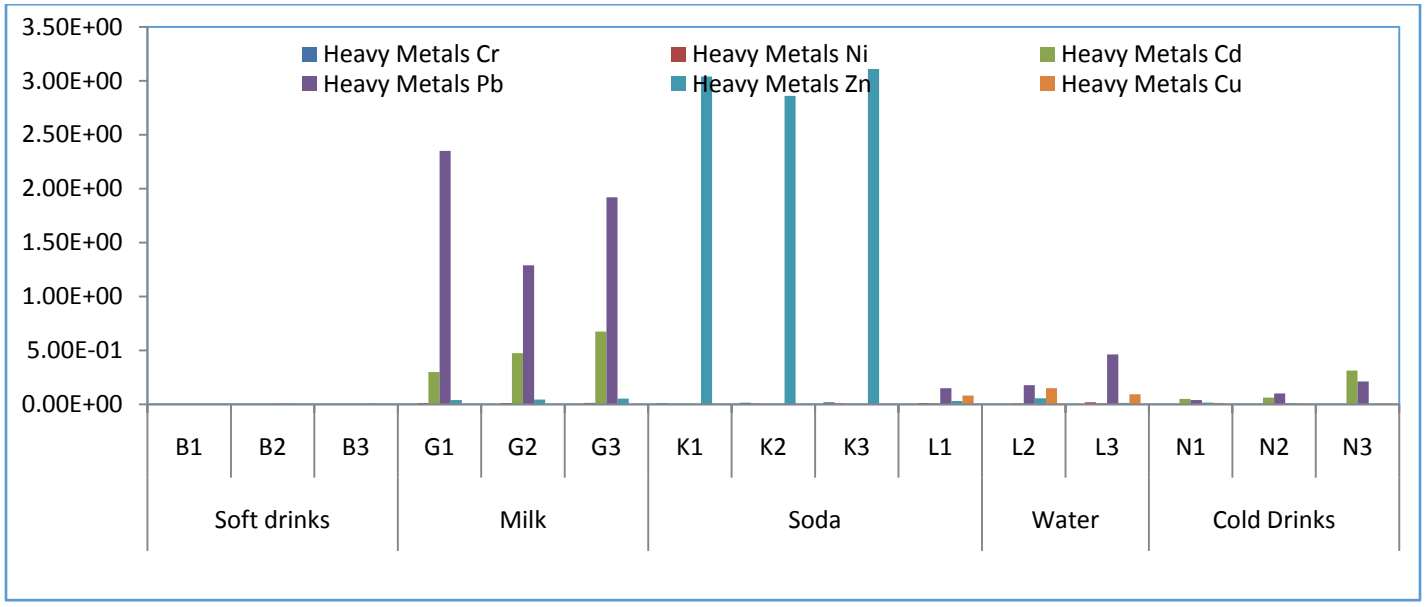

Figure3.4: - HQ for Children

5.Conclusion

The present study was conducted for analysis of heavy metals. From the selectedLiquid confectionary items which were purchased from the local market. From the study wecalculated the following: HQ of Cr in few sample was more than 1 in adultsand children both was found out of permissible limit. HQ of Cu in all samples of adults andchildren was below than 1 that is in allowable limit. The prolonged consumption of theseliquid Confectionary items, there is possibility of associated Health Hazard over a longperiod. The results also indicate that concentration of all studied heavy metal was foundbelow the National and International standards except few confectionary items. The Concentration of trace elements to cause serious health risk to consumption of these items.The results of the study showed that ADD and HQ suggest that the consumption of these Confectionary item's are contaminated with heavy metals, but all are free from any serious risk. Thepresent study indicates that there is regular check of these confectionary items by the Govt.

References

- Zhou H, Yang WT, Zhou X, et al. Accumulation of heavy metals in vegetable species planted in contaminated soils and the health risk assessment. Int JEnv Res Pub Health. 2016;13(3):289.

- I. Alajta, Mohamed A Elbagerma, Edwards, H.G.M. (2012). Monitoring of Heavy MetalContent in Fruits and Vegetables Collected from Production and Market Sites in theMisurata Area of Libya, Analytical Chemistry, 1(3), 1-5.
- Magomya, A.M.,Yebpella, G.G., Udiba, U.U, Amos, H.S, Latayo, M.S. (2013).PotassiumBromate and Heavy Metal Content of Selected Bread Samples Produced in Zaria,Nigeria, International Journal of Science and Technology,2(2),42-46.
- Abdulkhaliq, A.,Swaileh, K. M., Hussein, R. M., Matani, M.(2012). Levels of metals (Cd,Pb, Cu and Fe) in cow's milk, dairy products and hen's eggs from the West Bank,Palestin International Food Research Journal 19(3), 1089-1094.
- Ackah M., Anim A.K., Zakaria, N., Osei, J., Saah-Nyarko, E., Gyamfi, E.T., Tulasi, D., Enti-Brown, S., Hanson, J., Bentil, N.O.(2014).Determination of some heavy metal levels inPackaged fruit juiceon the Ghanaian market using atomic absorption spectrometrymethod,EnvironMonit Assess. 2014 Dec186(12), 8499-507.
- Adriana Dehelean and Dana Alina Magdas(2013).Analysis of Mineral and Heavy MetalContent of Some Commercial Fruit Juices by Inductively Coupled Plasma MassSpectrometry,The Scientific World Journal, 2013(2013),1-6.
- Adu, A.A, Aderinola, O.J.,Kusemiju, V. (2014). Assessment of Trace Metal Levels inCommonly Edible Vegetables from Selected Markets in Lagos State, Nigeria,CurrentWorld Environment Vol. 9(3), 789-796.
- Afrasiab Khan Tareen, ImranaNiazSultan, PramukParakulsuksatid, Mohammad Shafi,AshrafKha , Mohammad Waseem Khan, Sadat Hussain (2014).Detection of heavy metals (Pb,Sb, Al, As) through atomic absorption spectroscopy from drinking water of DistrictPishin, Balochistan, Pakistan, Asian Journal of Science and Technology,3(1),299-308.
- Ali Duran, Mustafa Tuzen, Mustafa Soylak (2008).Trace metal contents in chewing gumsand candies marketed in Turkey.February 2009, Environ Monit Assess.149(1), 283-289.
- Alina Magdas and Adriana Dehelean(2013).Analysis of Mineral and Heavy Metal Content ofSome Commercial Fruit Juices by Inductively Coupled Plasma Mass Spectrometry,TheScientific World Journal 2013(1), 215423.

- Anilaanwar, Talatmahmood, Tamar- ui- haque, Muhammad zohaib khan, Farah kiswar,Rubinaperveen, Shaistaismat(2014).Heavy metals in fruit juices in different packingmaterial, fuuast j. biol., 4(2), 191-194.
- Chukwujindu M.A. Iwegbue (2012).Metal Contents in Some Brands of Biscuits Consumed inSouthern Nigeria, Food Technology, 7, 160-167.
- Chukwujindu M.A. Iwegbue, Sarah O. Nwozo, Chukwudumebi, L. Overah, Francisca, I.Bassey, Godwin E. Nwajei(2013).Concentrations of Selected Metals In Some Ready-To-Eat-Foods Consumed in Southern Nigeria: Estimation of Dietary Intakes and TargetHazard Quotients.Turkish Journal of Agriculture - Food Science and Technology, 1(1):1-7.
- Chukwujindu M.A. Iwegbuea (2011).Concentrations of selected metals in candies andchocolates consumed in southern Nigeria, 4(1)108-121.
- Doreen Amponsah (2014).Determination of levels of heavy metals (arsenic, lead, cadmiumand mercury) in tin milk produced in Ghana,International Journal of Advancements inResearch & Technology, 3(6)129-133.
- Doe, E. D., Awua,A. K.,Gyamfi, O. K., Bentil, N. O.(2013).Levels of selected heavy metalsin wheat flour on the ghanaian market: a determination by atomic absorptionspectrometry, 1(2), 67-72.
- Engwa Azeh Godwilla, Ihekwoaba Cynthia Janea, Ilo Uchenna Scholasticab, Unaegbu mMarcellusa, AyukL.Eugeneb, Osuji Amara chukwu Gloriab (2015).Determination ofsome soft drink constituents and contamination by some heavy metals in Nigeria,Toxicology Reports 2(2015)384–390.
- Gerhard Gramss and Klaus-Dieter Voigt(2012).Regulation of heavy metal concentrations incereal grains from uranium mine soils,Plant and Soil 364(1-2), 1338-1339.
- Ghulam QadirShar, Tasneem Gul Kazi, Wahid BuxJatoi, Pirbho Mal Makhija,ShamrozBanoSahit, Abdul Hussain Shar and Fateh Soomro(2013).Determination ofHeavy Metals in Eight Barley Cultivars Collected from Wheat Research StationTandojam, Pak. J. Anal. Environ. Chem. 14(1), 47 – 53.

- Girma W. Woyessa, Solomon B. Kassa, Ephrem G. Demissie(2015).Determination of thelevel of some trace and heavy Metals in some Packaged fruit juiceof Ethiopia, JCBPS; SectionD; 5(2)2108-2114.
- H. F. Al-Mudhaf, H. M. Alzaid, A. I. Abu-Shady(2016).Study of Trace and Heavy MetalsContent of Packaged fruit juicein the State of Kuwait, 2248-9622, 5(2), (Part - 1)01-06.
- HavanurPriyaPramod and HawareDevendra J(2014).Determination of Specific Heavy Metalsin Fruit Juices Using Atomic Absorption Spectroscopy (AAS), Haware et al. Int. J. Res.Chem. Environ, 4(3) (163-168).
- Hifsa Mubeen, IsmatNaeem, AbidaTaskeen, Zeb Saddiqe(2009). Investigations Of HeavyMetals In Commercial Spices Brands, New York Science Journal, 2(5), ISSN 1554-0200.
- ItharKamil Al-Mayaly(2013). Determination of some heavy metals in some artificial fruitjuices in IRAQI local markets, 2(4) 507-510.
- J. O. Ochu, A. Uzairu1, J. A. Kagbu1, C. E. Gimba1, O. J. Okunola(2012).Evaluation ofSome Heavy Metals in Imported Chocolate and Candies Sold in Nigeria, Journal ofFood Research; 1(3),169-177.
- J. Raj, Anupuma Raina1, Mohineesh, T. D. Dogra(2013). Direct Determination of Zinc,Cadmium, Lead, Copper Metal in Tap Water of Delhi (India) by Anodic StrippingVoltammetry Technique,E3S Web of Conferences,1(2013),0-4.