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ANALYSIS OF HEAVY METAL CONTAMINATION IN PACAKAGED CONFECTIONARY ITEMS

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ABSTRACT

Analysis of Six heavy metals Cd, Ni, Zn, Cr, Pb and Cu were measured in eleven types of packaged confectionary items by atomic absorption spectroscopy (AAS). Three different brands of each item have analyzed to find out the heavy metal concentration.

All packaged confectionary items of different brands and different batches were collected from local market of Hisar. To calculate the health risk associated with accumulation of heavy metal contaminated foods, Hazards quotient (HQ) has been recognized as useful index. If HQ is greater than one (HQ>1), It can cause potential health risk. The daily Consumption of heavy metal with packaged food was also calculated, and results shows that maximum intake of Zn followed by Cr, Pb, Cu, Cd, and Ni. Results of analyzed confectionary item tell about the possible lifelong carcinogenic and non-carcinogenic health hazard to peoples due to analyzed consumption rate.

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

1. INTRODUCTION:-

Trend of packaging foods is increasing day by day in India, even in small cities also. Sometimes packaging foods have lots of contamination and heavy metal is one of them. Heavy metal contamination even in very low concentrations in foods, have the potential to cause human health problems. The implication related with heavy metal is of great concern for human health and can pose a significant health risk.(Gupta and Gupta, 1998).

Heavy metals are neither biodegradable nor thermally decomposable and they can persistent for a long life in human body through dietary intake (Zhou H et al., 2016). Heavy metal concentration 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 a harmless 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 Group 2A, 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).

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 get information about the dietary intake of heavy metals in adults and children. Arsenic toxicity mainly depends on the physical and chemical properties of the compound in which it exist. On accumulation of heavy metal, it affects the liver, kidney, lung, spleen, aorta and skin (M.A Oliver et al). Symptoms of chronic arsenic include general debility, weakness, loss of appetite and energy, hoarseness of the voice, hair loss, weight loss and mental abnormalities. Cadmium exposure related to kidney stones. Zinc, an essential trace element for human body and it found more contaminated in salt form rather than in elemental form. Exposure of zinc related to pulmonary toxicity, gastrointestinal toxicity, and neurotoxicity (H lokeshwari et al. 2006). Copper is also necessary metal for human body for both physical and mental development. But more than permissible limit it can cause serious ill for human like fatigue, scoliosis, cancer, migraine, osteoporosis, insomnia, heart disease, heart seizures, gum diseases, skin and hair problems. Nickel is an important element for human

body and it is not known to be toxic for human body. Nevertheless, nickel can combine with carbon monoxide and form a complex compound called nickel tetra carbonyl (Ni (CO) 4). This is more poisonous than carbon monoxide. High dietary intake of the nickel is associated with increased heart disease thyroid problems and cancer. Lead toxicity affects almost every organ in the human body.

2. 0 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.

2.1 Samples 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.

2.3 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 was determined 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 considers one in all cases, B_w is body weight for adult (60kg), *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)

3.0 Result and discussion.

The study was conducted in order to analysis of heavy metals in packaged confectionary food (Biscuits, snacks, massaalas, Tea, Cake, chocolates, toffees, Sauce, Noodles, Chips, Bhujia, etc.). All confectionary items of different brands and different batches were collected from local market of Hisar. The results of heavy metal concentration in different brands of packaged confectionary are presented in Graphs.

3.1 Concentration of Heavy Metals.

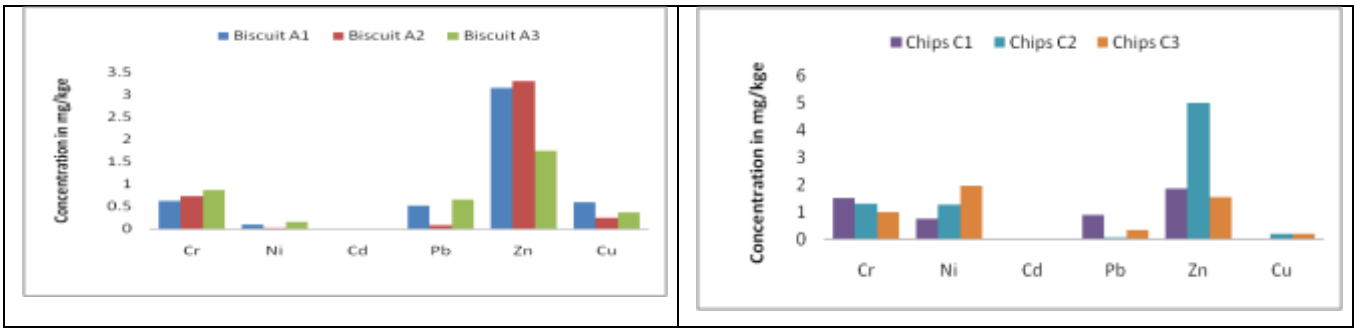


Fig 3.1 Concentration (mg/kg) of Heavy Metals in three samples of Biscuits and Chips

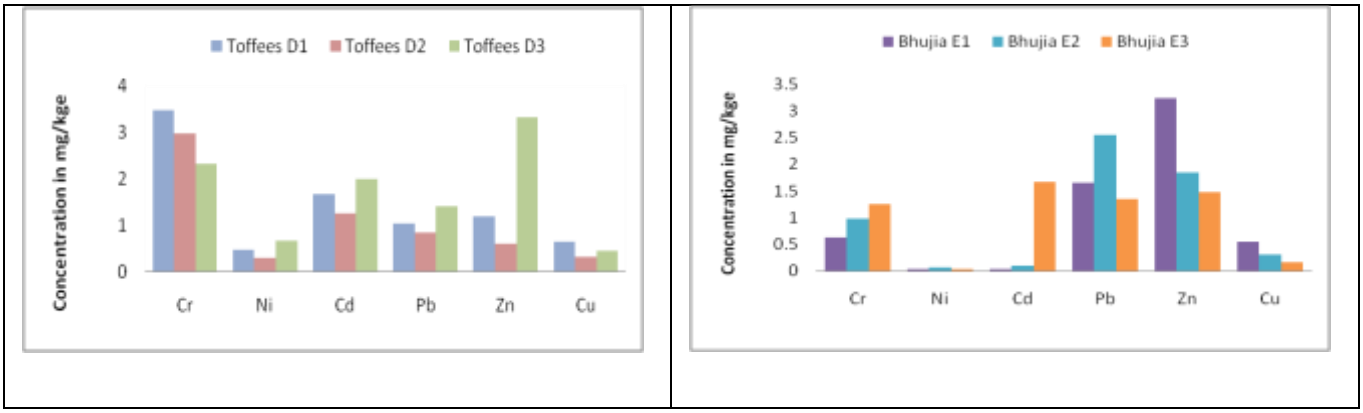


Fig 3.3 Concentration (mg/kg) of Heavy Metals in three samples of Toffees and Bhujia

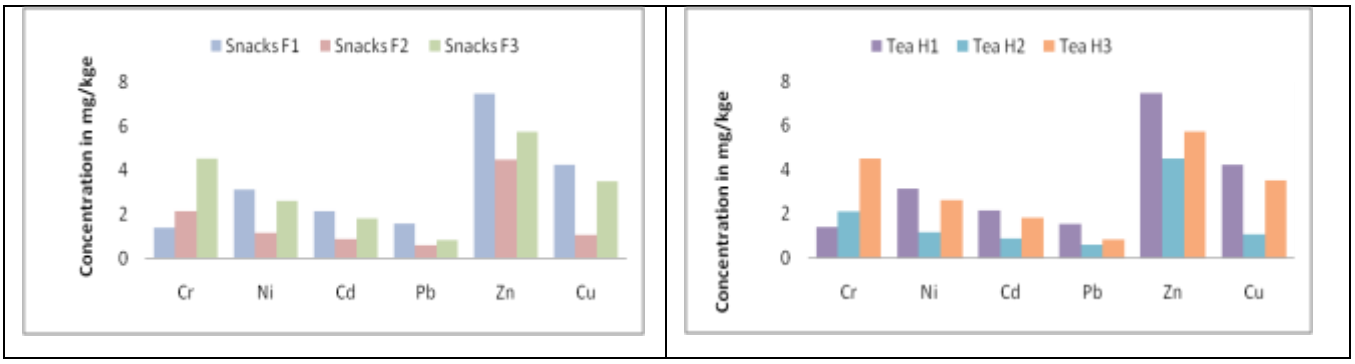


Fig 3.5 Concentration (mg/kg) of Heavy Metals in three samples of Snacks and Tea.

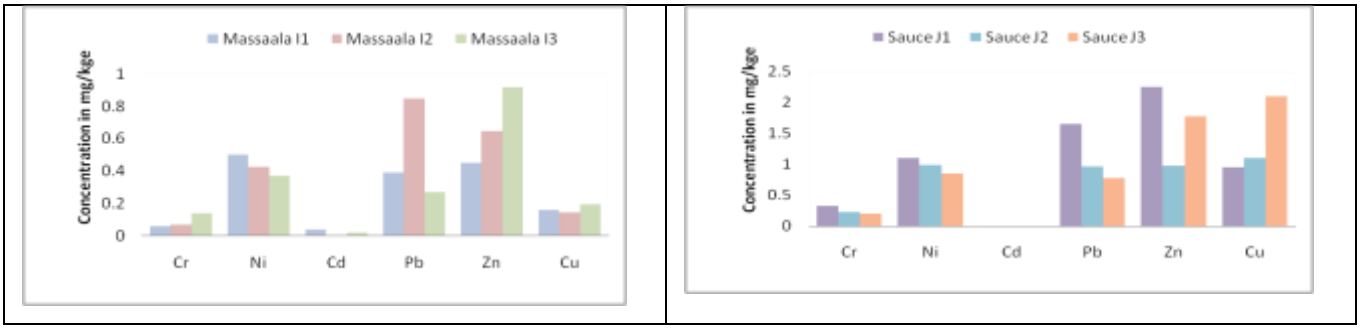


Fig 3.7 Concentration (mg/kg) of Heavy Metals in three samples of Massaala and Sauce.

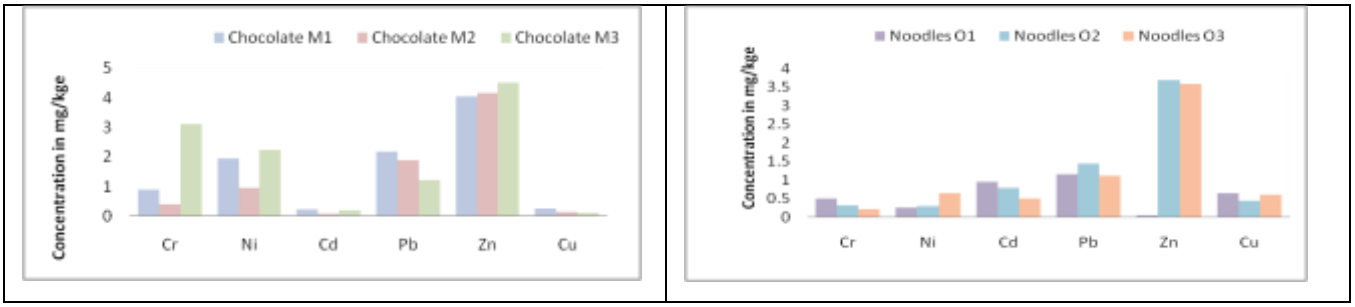


Fig 3.9 Concentration (mg/kg) of Heavy Metals in three samples of Chocolate and Noodles.

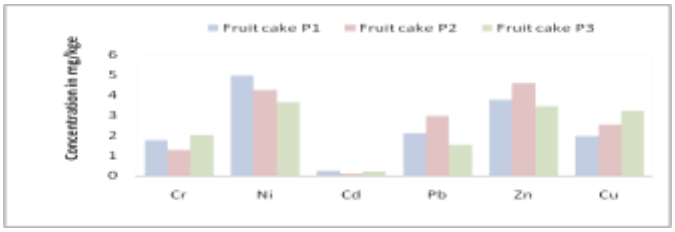
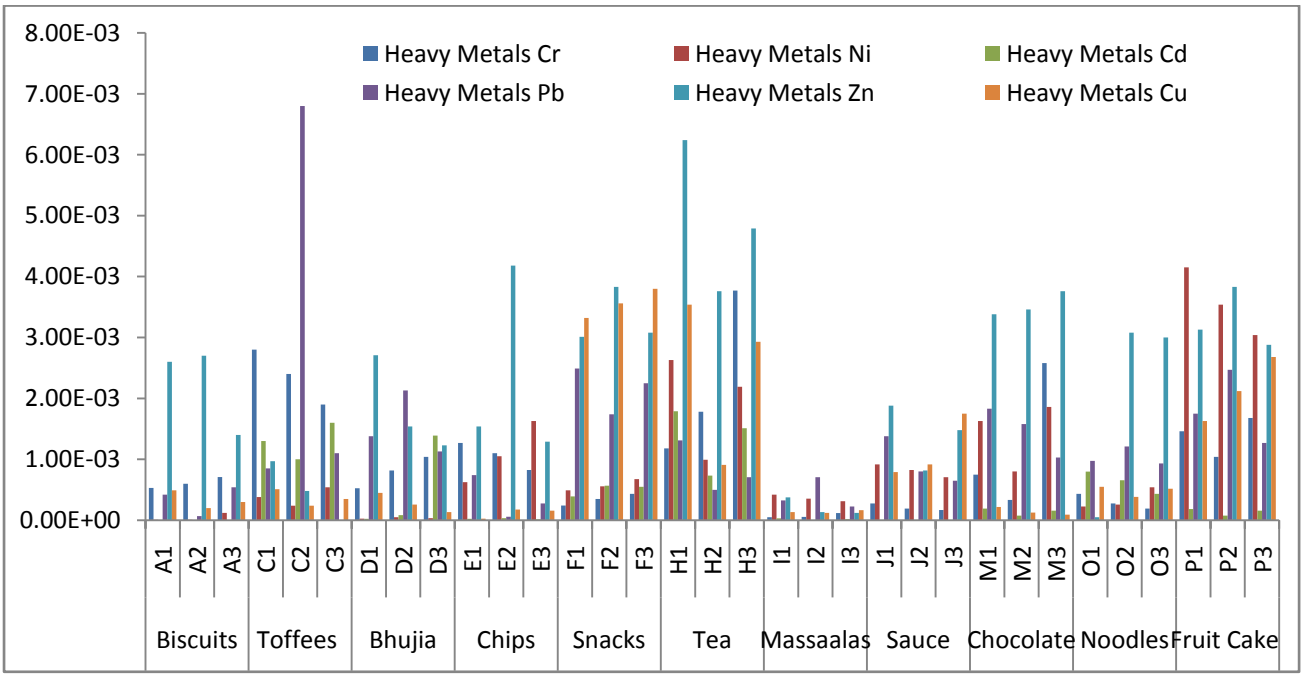


Fig 3.11 Concentration (mg/kg) of Heavy Metals in three samples of Fruit Cake.

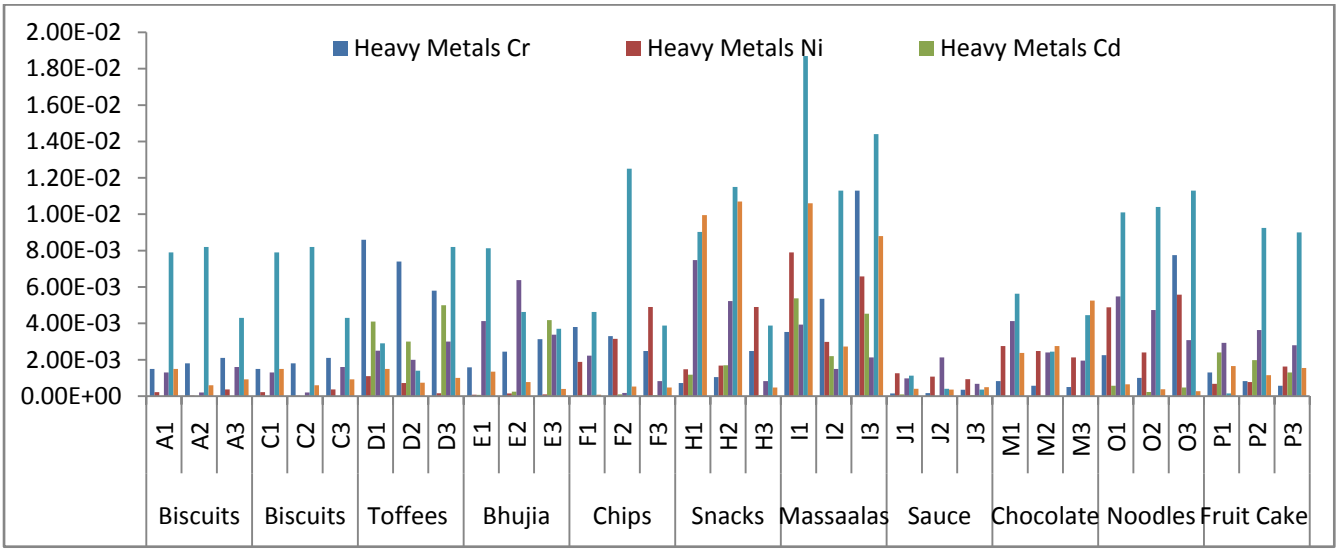
3.2 The average daily dose (ADD)

The result indicates that the ADD of heavy metals (Cd, Cu, Cr, Zn, Pb and Ni) in packaged food was found in trace amount. The average daily dose in different food items for adults and Children are shown in different tables.

For Adults:-



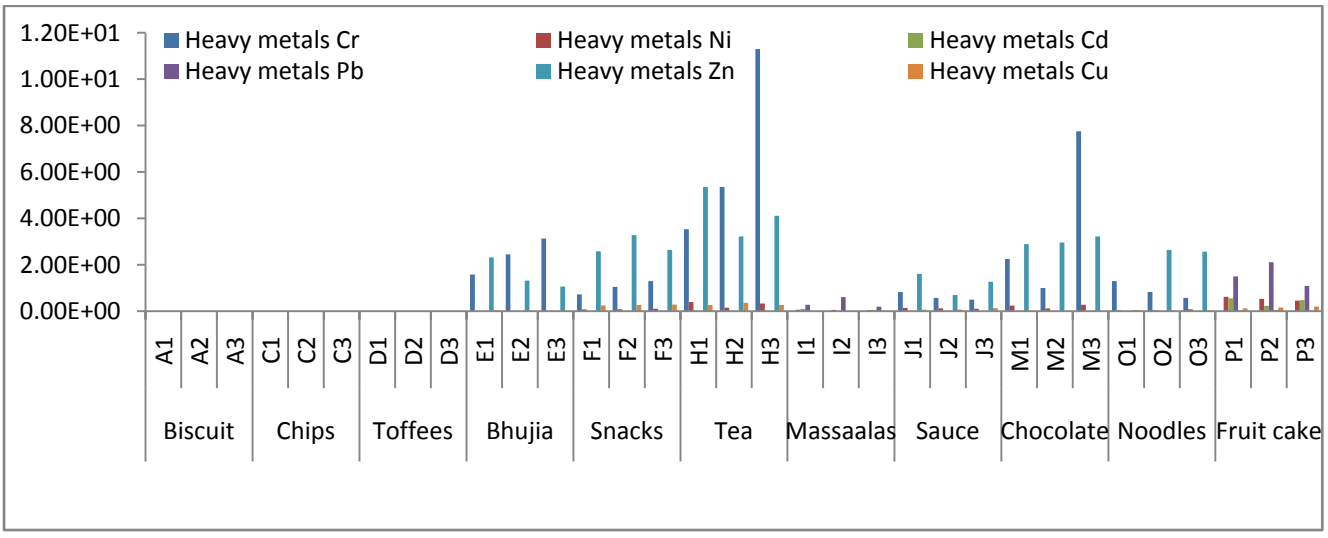
For Children:-



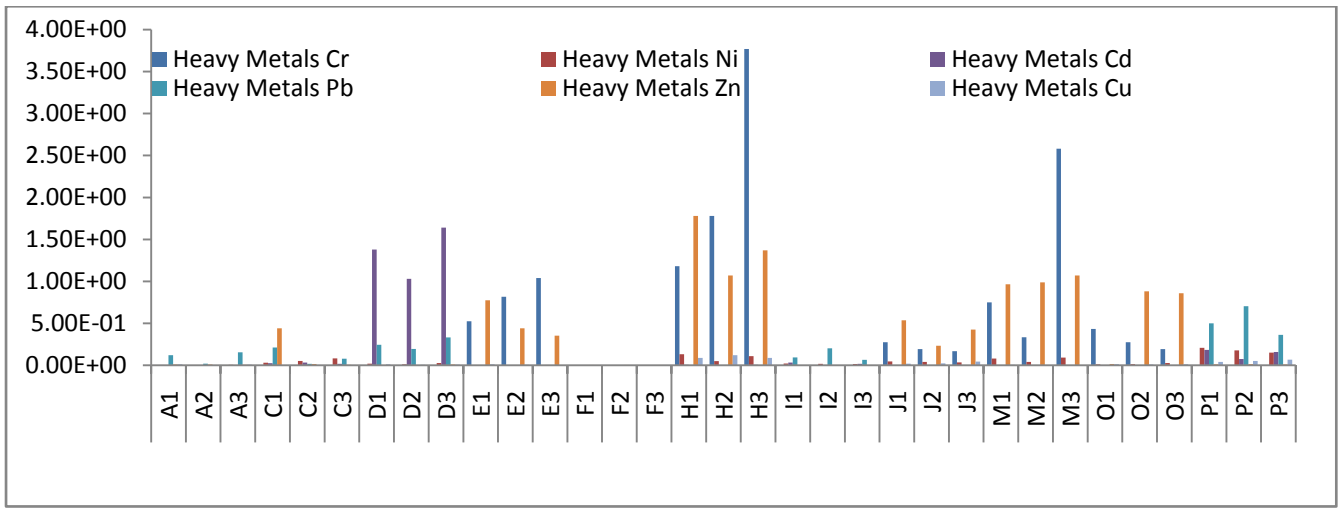
3.3: Hazard quotient (HQ)

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 and 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

For Adults



For Children.



4.0 Conclusion

The results of present study showed that, HQ of Cr in all three samples of Bhujia, all three samples of snacks, and one sample of chocolate(M3) for adults and, Two samples of Chips F2 & F3, Two sample of snacks H2 & H3, and two samples of chocolate M1 & M2 for children was found more than 1. It showed that regular consumption of these confectionary items may cause adverse effect on human health.

HQ of Ni in all the sample of packaged confectionary items were found for adults and children is below than 1 or we can say it within permissible limit.

HQ of Cd in all three samples of toffee was found more than 1 so it may cause adverse effect on health for children, in case of adults, it was found within permissible limit. HQ of Pb in all three of snacks sample was found more than 1 in case of children and all other sample was found within permissible limit.

HQ for Zn in all samples of snacks, bhujia tea, sauce, chocolate and two samples of noodles O2 & O3 was more than 1 in case of adults and children both was found out of permissible limit.

HQ of Cu in all samples of adults and children was below than 1 that is in allowable limit.

To assess the health risk associated with heavy metal contamination of packaged Confectionary by selected age group. Hazard Quotient (HQ) has been recognized as useful parameter for evaluation of risk associated with consumption of metal contaminated packaged foods. Hazard Quotient (HQ) of heavy metals (Ni, Cd, Cr, Pb, Zn and Pb) via consumption by adults and children was less or more than one. Therefore there are health hazards in adults and children by consumption of selected packaged confectionary items which have HQ more than 1.

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