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EXTRACTION OF HEAVY METALS IN FRUIT JUICE COLLECTED FROM MARKETS IN AND AROUND GOREGAON SUBURBAN AREA OF MUMBAI

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ABSTRACT Samples (fruits) were collected from various markets of Goregaon market in the month of December and washed under running water &Kept in deep freezer until use. The fruits were identified as per the guideline given in the literature. Fruits were processed for digestion in the zoology laboratory as per the procedure. The results were obtained as A1, Co, Fe, and Ni higher than the WHO Standard. The results of the study reveal that the fruits were contaminated by metal ions. Present study suggests that due to presence of heavy metals in fruits may pose health hazards therefore; further study is required to minimize the evils of danger.

KEYWORDS : Fruit, Metal contamination, ICP-AES

INTRODUCTION:

Fruit is the seed-bearing structure in flowering plants. Fruit is a great source of food for humans and many animals. They are readily available natural source of vitamins essential for human body. Fruits can be eaten raw, frozen, stewed, cooked or dried. Fruits are also known to be boosters as they contain essential body nutrients. Fruits are meant to be nutritious and our sole companion that makes them our best friends. When it comes to the applications of fruits, they are never ending. They are consumed as food and products such as salads, juices and much more. Fruits are basically classified into three distinct types based on their nutritional value, composition as simple fruits, aggregate fruits and multiple fruits are amongst the major diet in almost all countries. Fruits are a rich source of essential nutrients and are rich in vitamin C and A (Based on the fruit) (Nnam and Njoku, 2005). Fruits and their juices are known to contain antioxidants, antibacterial, & antifungal properties. Fruit juices contain nutrients as minerals as minerals, trace elements, vitamins and phytochemicals antioxidant (Tasnim et al.,a, 2010). Fruit juices are available in any place in the world are available in bottles, cans, Iaminated paper packs, pouches, cup and almost every other form of packaging in the diet of most people, irrespective of age included significantly thus, it contributes to good health (Tasnim et al., b, 2010). In most countries, the hot climate means that the intake of liquids must be high to compensate for the expected losses from respiration (Jedah and Robinson, 2002; Victor et al., 2012). Fruits are a rich of essential nutrients such as calcium is essential for bones and teeth, required for normal functioning of nerves, muscles and glands. Fruits are rich in fibre; they help in digestion and decrease the risk of heart coronary disease. Iron is essential for health blood & normal functioning of body cells. Magnesium, sodium, potassium required for healthy bones, proper functioning of body cells, & healthy blood pressure. Vitamin A Vitamin C these are the major components & keep the body protected against infections. Vitamin A keeps eyes and skin healthy whereas Vitamin C helps to heal cuts & wounds. All these nutrients play an important role to human body by nourishing our body by essential vitamins and other healthy constituents of the fruits. A heavy metal is a dense metal that is toxic even in a low concentration (Answar et al., 2014).

MATERIALS AND METHODOLOGY:

a) Collection of Samples:

Samples (fruits) were collected from various markets of Goregaon in the month of December and washed under running water & Kept in deep freezer until use. The fruits were identified as per the guideline given in the literature. Fruit were processed for extracting the juice. Extracted juices dried at 80^{0}C in the oven. 100 ml juice was extracted from respective fruits and oven dried and samples were processed further.

b) Extraction of Metals:

The fruit juices samples, packed in propylene bags, were stored at 20 ^{0} C in deep freeze in the Department of Chemistry, at the S.S & L.S. Patkar College, Goregaon (West) Mumbai for sample digestion.

c) Sample Digestion:

The method was followed with some modifications as prescribed by Ogabiela et al., (2011). 1ml of the fruit juices sample taken in a Kjeldal flash was added 5 ml of concentrated hydrochloric acid (HCl) and 5 ml of concentrated per chloric acid ($HClO_4$) acid. This mixture was digested by heating the flask in a hearing mantel, and 30% hydrogen peroxide was added to it intermittently till a pale yellow coloured solution was obtained. The digestion flask was further heated gently until frothing subsided and the sample was then heated to dryness. The residue so obtained was dissolved in 30 ml of deionized water and the solution was filtered using whatman filter paper No 1. The digested samples were quantitatively transferred into 50 ml flask, and then diluted with distilled water up to the mark and in a polypropylene bottle. The above procedure was repeated for the entire sample. All above chemicals used were of analytical grade.

d) Preparation of standard metal ion solutions:

Stock solution (1 ug / ml) of each of the metal ions were prepared using appropriate metal salt of AR grade quality in diluted in hydrochloric acid. The working standard of these solution were prepared by adding appropriate amount of distilled water to make the volume 50ml.

e) Instrumentation:

The samples were analysed on Inductively Coupled Plasma Atomic Emissions Spectroscopy (ICP-AES Model ARCOS from M/s. Spectro, Germany) at the Sophistication Analytical Instrument Facility (RSIC), Indian Institute of Technology (IIT) Powai, Mumbai-400076, India.

RESULTS AND DISCUSSION:

Table No.1 Showing Samples Metal Ion Concentration In PPM In Fruit Samples Collected From Various Markets Of Goregaon, Mumbai.

Sr. No	Sample	Al	Co	Cr	Fe	Cd	Mg	Ni	Pb	Zn	Hg
1	*(Citrus reticulate) Orange*	1.505	ND	0.031	2.165	ND	22.552	ND	ND	0.044	ND
2	*(Fragariaanass) Strawberry*	20.77	0.02	0.053	22.456	ND	49.746	0.036	ND	0.166	ND
3	*(Citrus limett) Sweet Lime*	1.579	ND	0.056	3.958	ND	57.55	0.011	ND	0.94	ND
4	*Guava (Psidiumguajava)*	0.521	ND	0.033	1.784	ND	12.132	0.014	0.012	0.207	ND
5	*Papaya (Carica papaya)*	2.216	ND	0.028	4.722	ND	35.294	0.011	ND	0.124	ND
6	*Apple (Mahuspamguajava)*	0.705	ND	0.024	1.153	ND	11.87	0.017	0.068	0.221	ND
7	*Pineapple (Ananascomosus);*	1.375	ND	0.032	2.068	ND	11.87	0.017	0.068	0.221	ND
8	*Chikoo (Manikarazaota)*	0.537	ND	0.042	0.968	ND	9.857	ND	0.061	0.218	ND
9	*Grapes (Vitisvnifera)*	3.782	ND	0.045	5.304	ND	33.875	0.017	0.058	0.539	ND
10	*Banana (Musa)*	1.000	ND	0.032	1.44	ND	148.144	0.023	0.077	0.578	ND

All the readings were taken in 5 replicates
ND = Metal ion is not detected or when it is detected its concentration is less than 0.01

DISCUSSION:

Aluminium (AI): The possible contamination of fruits with Aluminium can occur from higher Aluminium content in water or highly contaminated soil. Relationship between high aluminium in the soil and fruit leads to anaemia, blood disorders, hyperparathyroidism, kidney and liver dysfunction, Parkinson's disease. Aluminium is potentially a toxic metal, and aluminium and neurological dysfunction. Such conditions are more prominently observed in people with chronic renal failure and especially in people on haemodialysis. In our present day study, the lower concentration of Aluminium has been found in Guava (0.521 ppm) whereas highest concentration was detected in Strawberry (20.77ppm).

Cobalt (Co): The possible contamination of fruits with Cobalt can occur from higher Cobalt content in water or higher contaminated soil. Cobalt is not often freely available in the environment but when cobalt particles are not bound to soil, the uptake by plants and animal is higher and accumulation may occur. Cobalt is used to treat anaemia with pregnant woman, because it stimulation the production of RBCs. However too high concentration of cobalt may damage human health mainly people that work with cobalt. Health effects may also be caused by radiation of radioactive cobalt isotopes. This can cause sterility, hair loss, vomiting, bleeding, diarrhoea, coma, and even death (Zodape, (2016). Accounting to WHO the acceptable limit for Cobalt is 0.1 ppm. In our present day study, cobalt is present only in strawberry (0.02 ppm) and no cobalt was detected in remaining samples.

Chromium (Cr): The possible contamination of fruits with Chromium can occur from higher Chromium content in water or highly contaminated soil. Chromium compounds have been found to be mutagenic and carcinogenic in a variety of test systems. Death in acute chromium poisoning is usually due to uraemia. Chronic intoxication by inhalation or skin contact leads to incapacitating eczematous dermatitis, with oedema and ulceration (Upreti et al., 2004). Chromium is also a compound of biological interest, probably having a role in usually due to uraemia. Chronic intoxication by inhalation or skin contact leads to incapacitating eczematous dermatitis, with oedema and ulceration. Accounting to WHO, the acceptable limit is 0.05ppm. In our present study, lowest concentration was found in Apple (0.02ppm) and higher concentration is found in Sweet lime (0.05ppm) it is under the permissible limits as prescribed by WHO.

Iron (Fe): The possible contamination of fruits with Iron can occur from higher Iron content in water or highly contaminated soil. Iron toxicity includes nausea, vomiting pain, diarrhoea, gastro-intestinal disorders (Powell et.al., 1980), thalassaemia, and neoplasm (Lante et.al. 2006). The target organs for toxicity are heart, kidney, liver and lungs. The ingestion of large quantities of iron results in Haemochromatosis, a condition in which normal regulatory mechanisms do not operate effectively (Hoops 1972, Stein et.al, 1976). Tissue damage occurs in association with excessive intake of iron. Poisoning of small children has occurred following ingestion of large quantities of iron tablets. Due to iron deficiency most woman suffer from anaemia whereas high intake leads to pre-menopause (Gibson et.al.,1984). (Zodape et.al.,2016). In our present day study, the highest concentration of Iron has been found in Strawberry (22.456 ppm) whereas lowest concentration is found in Chikoo (0.0968ppm).

Cadmium (Cd): The possible contamination of fruits with cadmium can occur from higher Cadmium content in water or highly contaminated soil. Toxicity function effects include food poisoning, bronchitis pneumonitis, and pulmonary oedema. If cadmium is ingested in high doses, it irritates the gastric epithelium and causes gastric disorders. The kidney is critical organ of intoxication after long-term exposure to cadmium. One of the initial signs renal dysfunction is an increased urinary excretion of protein. Cadmium induced proteinuria is generally considered to be characterised by the excretion of low molecular weight proteins. This from of proteinuria caused by an impaired re-absorption function of the proximal tubules is not specific for the metal and may be found in hereditary forms of dysfunction (G.V.Zodape 2016). According to WHO, the acceptable limits of cadmium fruits is 0.003 ppm. In our study, the values of the minimum and maximum concentration of cadmium in fruit samples were not detected as these concentrations were either less than 0.001 ppm or absent in all the fruit samples.

Magnesium (Mg): The possible contamination of fruits with magnesium can occur from higher magnesium content in water or highly contaminated soil. Magnesium toxicity includes hypotension, nausea, vomiting, and retention of urine, muscle weakness, difficulty in breathing, facial flushing, depression and lethargy before progressive to muscle weakness, irregular heartbeat, low BP, confusion, coma and death. Hypomagnesaemia is an electrolyte disturbance in which there is a high level of magnesium in the blood. In our present day study, the higher concentrations of magnesium have been found in Banana (148.14ppm) whereas lower concentration is found in Chikoo (9.85 pmm).

Nickel (Ni): The possible contamination of fruits with nickel can occur from higher nickel content in water or highly contaminated soil. Nickel causes essential metal imbalances and severely disrupts enzyme action and regulation. It also contributes to a high amount of oxidative stress. Nickel is called depression and suicide metal as it is associated with the feelings and symptoms. It is particularly deadly toxic metal. Small amount of nickel is needed by the body to produce RBCs however excess amount can become toxic. According to WHO, the acceptable limit of Ni is 0.07 ppm. In our present day study, the higher concentrations of nickel have been found in Strawberry (0.032ppm) whereas lower concentration is found in Sweet lime and Papaya respectively (0.01 ppm). The higher and concentrations of our study are less than WHO limit.

Lead (Pb): The possible contamination of fruits with Lead can occur from higher content in water or highly contaminated soil. It is known as deadly and accumulative poison even when consumed in small quantities and is capable of dealing nerve receptor in men (Goyer *et.al 1986*) acute intoxications only occur through the consumption of relatively large single doses of soluble lead salts. Chronic intoxications can arise through the regular consumption of foodstuffs only slightly contaminated with lead. Lead is a typical cumulative poison. The danger of chronic intoxications is the greater problems. From the public health point of view, lead toxicity reportedly causes renal tubular dysfunction indicated by proteinuria, aminoaciduria, glucosuria, hyper phosphatauria and important of sodium transport (Paglia *et. al 1975*, *Stowe et. al,* 1971). Lead toxicity also has multiple haematological causing shortening lifespan of circulating erythrocytes and inhibits haematological causing shortening lifespan of circulating erythrocytes and inhibits haemoglobin synthesis and causes fragile RBCs which results in anaemia. Clinically lead toxicity has been associated with sterility causing gametotoxocity effects in both male and female, reduction in sperm count, abnormal sperm motility and morphology. (Assenatio *et. al., 1986*) According to WHO, maximum acceptable range for lead in fruit juices is 0.01 ppm.mIn our present day study, the lower concentration is found in Guava (0.012 ppm) and the highest concentration of Lead have been found in Banana (0.07 ppm) which is higher than the WHO limits (0.01ppm). The concentration of lead was not detected in Orange, strawberry, Sweet lime, Papaya and Apple respectively as their concentration is below 0.001ppm.

Zinc (Zn): The possible contamination of fruits with Zinc can occur from higher Zinc content in water or highly contaminated soil. Both acute and chronic toxicity syndromes occur with large overdoses of zinc and the principal features are epigastria pain, diarrhoea, nausea and vomiting. In addition to the gastrointestinal effects, the central nervous system may be affected, showing symptoms such as irritability, headache and lethargy (Hambidge et al., 1986). Prolonged intake of a relatively modest excess of zinc may deoress serum high density lipoprotein cholesterol levels (Hooper et al., (1980)). Chronic ingestion of excess supplemental zinc (Zn) can produce anaemia and leucopoenia consequent to induced copper deficiency (Hoffman et al., (1988)). Zinc toxicity in humans from excessive dietary ingestion is uncommon, but gastrointestinal distress and diarrhoea have been reported (Reddy & Hayes 1989)); Walshe et al. (1994); Casarett& Doull's (1996). In our study, the highest concentrations of zinc have been found in Banana (0.94 ppm) whereas lowest concentration is found in Orange (0.044 ppm).

Mercury(Hg): The possible contamination of fruits with Mercury can occur from higher Mercury content in water or highly contaminated soil. Accumulation of mercury only takes place temporarily and a large part of it is excreted with the faeces. The salts of bivalent mercury, in the case of chronic consumption, first causes tiredness, loss of appetite and weight loss and finally cause the failure of kidneys. Muscular weakness and paralysis are typical. Symptoms of mercury poisoning

are physical and emotional disturbances, self-consciousness, timidity, embarrassment with insufficient reasoning, anxiety, lack of concentration, depression, irritability or excitability and complete change in personality. In the present day study, the values of the minimum and maximum concentration of mercury in fruit samples were not detected as these concentrations were either less than 0.001 ppm or absent in all the fruit samples.

CONCLUSION:

There is an increased incidence of different diseases amongst the rural and urban population. Such problems could be associated with their dietary habits among which could be high fruits intake. In the present day study, out of ten metal ions, seven metals ions are detected. Out of these seven metals the four metals showed high range of metal ions than the prescribed WHO values. So danger cannot be ignored. From the above study it can be inferred that in some of the samples of fruit juice there are certain metal contaminants which cross the tolerable limits as prescribed by the WHO. This is mainly due to greater environment pollution of water and soil by heavy metal which exposes man to health risks. This preliminary study highlights the need of study the toxicological implications of chronic low level exposure of human beings to heavy metals founds in fruits collected from in and around Goregaon suburb area. Further studies are therefore necessary to evaluate the level of metals by analysing large number of fruit samples from the region. A comprehensive study of metal level in water, soil and fruit crops should be carried out by the government agencies or institution to ascertain the extent of pollution. Environmental impact assessment should be carried out in Maharashtra particularly in big metropolitan cities like Mumbai. Educational programme should be carried out create awareness on the dangers of metal poisoning amongst the population. Further studies are necessary to evaluate the contents of essential and toxic heavy metals on a greater of fruit samples available in Mumbai city.

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