

Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231-6345 (Online)
An Open Access, Online International Journal Available at <http://www.cibtech.org/jls.htm>
2014 Vol. 4 (1) January-March, pp.209-212/Poornima et al.

Research Article

ANALYSIS OF HEAVY METALS IN EDIBLE JAMS -A CASE STUDY

*S. Poornima, S. Ashwini and S.M. Balakrishna

Division of Biological Sciences, Bangalore University, Bangalore-560056

**Author for Correspondence*

ABSTRACT

Heavy metals are present naturally in relatively low amounts in the earth's crust. Through food, drinking water and the air, humans absorb trace amounts of these elements. Trace amounts of some heavy metals, such as selenium, zinc, and copper, are key to maintaining the metabolism of the human body. At high concentrations usually found in contaminated environments, such as and contaminated water, heavy metals can cause poisonings resulting in impaired mental and central nervous function, as well as damage to vital organs. Long-term exposure may result in slowly progressing physical, muscular, and neurological degenerative conditions including cancer. Arsenic, cadmium, mercury, lead and inorganic tin account for a majority of heavy metal poisoning cases involving food products. Levels of arsenic are naturally high in fish and seafood. Found in soil due to the presence of insecticides, fungicides, sludge and commercial fertilizers, cadmium can contaminate agricultural food products. Mercury is an industrial pollutant as well as a by-product of volcanic emission. In recent years, a number of products, ranging from protein shakes to baby formula to fresh produce, have been linked to heavy metal contamination. Spurred by consumer calls for safer products, regulatory agencies around the globe are taking steps to detect and minimize the presence of hazardous heavy metals in food. The Food and Drug Administration (FDA) enforces action levels for poisonous or deleterious substances in human food and animal feed, including cadmium, lead, mercury, and others. For most people, diet is the main route of exposure to trace metals, so the assessment risks of these elements to human via dietary intake is important.

Cooking jams using fruits, sugar, pectin and edible acids is one of the oldest food preserving processes known to mankind and presents a way of making food stable by increasing the content in soluble solids. In the recent times lots of research findings revealed the presence of deleterious artificial colorants above the permissible levels as well as the heavy metals in sweets, cakes, ice creams etc. Hence Spurred and encouraged by the above reports we authors in our studies analyzed 5 different mixed fruit jam samples of 5 different brands collected from 5 different areas of Bangalore city for some of the heavy metals like Cadmium, Lead, Chromium and Mercury. Our preliminary analysis revealed the minimal permissible levels of all the above mentioned heavy metals in all the 5 different brands which clearly confirms the very presence of the heavy metals at first and secondly also incites a doubt of their usage for human consumption especially for young children who like the very taste of it as to how safe are these Food stuffs contaminated with heavy metals and with carcinogenic artificial food colorants and hence we strongly recommend the Scientific Community to hold a detailed research of these Fruit Jam samples in the near future.

Keywords: *Heavy Metals, Prevention of Food Adulteration Act, Atomic Absorption Spectrophotometer (AAS), Mercury, Lead, Cadmium and Chromium*

INTRODUCTION

The main threats to human health from heavy metals are associated with exposure to lead, cadmium, mercury and arsenic. These metals have been extensively studied and their effects on human health regularly reviewed by international bodies such as the WHO. Heavy metals have been used by humans for thousands of years. Although several adverse health effects of heavy metals have been known for a long time, exposure to heavy metals continues, and is even increasing in some parts of the world, in particular in less developed countries, though emissions have declined in most developed countries over the last 100 years.

Research Article

Cadmium compounds are currently mainly used in re-chargeable nickel-cadmium batteries. Cadmium emissions have increased dramatically during the 20th century, one reason being that cadmium-containing products are rarely re-cycled, but often dumped together with household waste. Cigarette smoking is a major source of cadmium exposure. In non-smokers, food is the most important source of cadmium exposure; the Cadmium is added to the agricultural soil by fertilizer application. Recent data indicate that adverse health effects of cadmium exposure may occur at lower exposure levels than previously anticipated, primarily in the form of kidney damage but possibly also bone defects- Osteoporosis and Osteomalacia and fractures.

The population is primarily exposed to mercury via food, fish being a major source of methyl mercury exposure, and dental amalgam. The population does not face a significant health risk from methyl mercury, although certain groups with high fish consumption may attain blood levels associated with a low risk of neurological damage to adults. Since there is a risk to the foetus in particular, pregnant women should avoid a high intake of certain fish, such as shark, swordfish and tuna; fish (such as pike, walleye and bass) taken from polluted fresh waters should especially be avoided. The population is exposed to lead from air and food in roughly equal proportions. The lead emissions to ambient air have caused considerable pollution, mainly due to lead emissions from petrol. Children are particularly susceptible to lead exposure due to high gastrointestinal uptake and the permeable blood-brain barrier. The use of lead-based paints should be abandoned and lead should not be used in food containers. Lead pipes also causes drinking water Contamination. In particular, the public should be aware of glazed food containers, which may leach lead into food.

The Exposure to arsenic is mainly through intake of food and drinking water, food being the most important source in most populations. Long-term exposure to arsenic in drinking-water is mainly related to increased risks of skin cancer, but also some other cancers, as well as other skin lesions such as hyperkeratosis and pigmentation changes. While the Mercury is used in batteries, lamps and thermometers. The natural biological processes can cause Methylated forms of Mercury which bio accumulate over a Million-fold and Concentrate in living organisms especially Fish. The Monomethyl and Dimethyl Mercury are highly toxic causing Neurotoxic disorders.

The Chromium is used in pigments for paints, cement, paper, rubber and other materials. The low level exposure can cause ulceration and Skin irritation. Long term exposure can cause Kidney and Liver damage and also to circulatory and Nerve tissue. It accumulates in aquatic life adding to the danger of eating fish that may have been exposed to high levels of Chromium.

These heavy metals are dangerous because they tend to bioaccumulate, the bioaccumulation results in the increase in the concentration of a chemical in a biological organism over time. These accumulate in living organisms any time they are taken up and stored faster than they are broken down or excreted. These can enter a Water supply by industrial and Consumer waste or even from acidic rain breaking down soils and releasing heavy metals into the streams, lakes, rivers and Ground water. The research reports also substantiate the accumulation of Lead and Cadmium in Strawberry and Date fruits (Radwan.A, 2006). According to Bednarek (2006), the environmental study, carried out in the Lublin region, was aimed at assessment of strawberry fruit quality based on the contents of heavy metals (Pb, Cd, Ni, Zn, Cu, As, Hg) and finding correlation between these heavy metals and some properties of soil and plant. The average contents of heavy metals in strawberry fruit grown in the Lublin region (0.023 mg Pb, 0.020 mg Cd, 0.091 mg Ni, 1.228 mg Zn, 0.358 mg Cu, 0.0015 mg As, 0.00011 mg Hg kg⁻¹ of fresh matter) indicates that it did not exceed upper threshold of products of this type. So also the Apple juice containing the Heavy metal arsenic upto 10 PPM was reported by Food and Drug Administration (www.fda.gov).

There are several such reports on the Plants – weed, ornamental, vegetables and edible fruits as accumulators of Heavy metals. So, also at present a lot of focus is on the artificial colorants and heavy metal contamination in the food stuff- Sweets, Cake, Sugar candies available in the market and Especially to coat by the Effort of the Electronic Media in recent times have clearly revealed the very presence of the same by their Secret research and evaluation in the Food stuff prepared and Sold in the Market.

Research Article

The results of this survey and research was highly shocking and had alerted all the humans for the safe consumption of the Sweets, sugar candies, ice creams and Cakes and Other Sweet items prepared and Sold in the Market. With this people are now aware not to consume sweets coloured by the artificial colorants in non –permissible amounts, but instead to choose the ones coloured with Natural colorants extracted from Various Natural Food dye plants.

Hence in our Market today we get Sugar candies mostly which is Non - colored in plenty and people are aware currently to choose right kind of Food stuff for the safe consumption. Encouraged by the Above studies Especially by the Electronic media-the local Television channels which revealed the toxic elements in bakery items in particular sweets etc and so also since there were no earlier reports on the Edible Jams for the toxic compounds the authors were inquisitive and were encouraged to analyze the Edible Jam Samples Collected from different areas of Bangalore for the Heavy metals since It has become a part of daily diet which the children especially relish the most and since its prepared by one to many fruits, these Jams are Supposed to be Free of Heavy Metals, Artificial colorants if any and Safe for Human Consumption.

MATERIALS AND METHODS

The 5 different brands of Mixed Fruit Jam Samples were purchased from 5 different areas- Jayanagar supermarket, Local shop of N.R.Colony, Vidyanapuram, Basaveshwaranagar and from Peenya industrial Jam Industry of Bangalore City, Karnataka.

These samples were labelled as Samples 1-5 respectively. Out of the above 5 Samples, the first 4 Samples were with the Brand names and were quite famous ones and was available in all the shops while the last one was sold without any brand name.

All the above 5 samples were analyzed for some of the heavy metals like Lead, Chromium, Cadmium and Mercury using the Atomic Absorption Spectrophotometer by Director General of Health Services Manual – (DGHS) or by Prevention of Food Adulteration Act –(PFA ACT).

RESULTS AND DISCUSSION

Out of the 5 different Mixed Jam samples, the above mentioned first 4 samples with brand names were red in color while the 5th one was almost dark red to blackish in color and on the day of collection itself it had some dead bodies of the flies.

All the 5 samples revealed the presence of some of the heavy metals like Lead, Cadmium, Chromium and Mercury but in Permissible accepted levels (Table-1). The Sample- 1 collected from Nilgiris Supermarket – Jayanagar which is a very famous brand showed Cadmium less than 0.1 PPM, Lead less than 0.1 PPM, Mercury less than 0.001 PPM and the Chromium less than 0.05 PPM. The Samples 3, 4 and 5 collected from different areas of Vidyanapuram, Basaveshwaranagar and from the Peenya industrial Jam Industry also showed the same values as per Sample -1. While the Sample -2 collected from N.R. Colony showed the same values for Cadmium, lead and Mercury, while the Chromium was less than 0.1 PPM in the same.

Table 1 -Concentration of Heavy Metals in all the 5 different Mixed Jam Samples (In ppm)

SL.NO.	Colour of the Jam Samples	Cadmium (ppm)	Lead (ppm)	Mercury (ppm)	Chromium (ppm)
Sample-1	Red	Cd <0.1	Pb <0.1	<0.001	Cr < 0.05
Sample-2	Red	Cd <0.1	Pb <0.1	<0.001	Cr < 0.1
Sample-3	Red	Cd <0.1	Pb <0.1	<0.001	Cr < 0.05
Sample-4	Red	Cd <0.1	Pb <0.1	<0.001	Cr < 0.05
Sample-5	Brown- Black	Cd <0.1	Pb <0.1	<0.001	Cr < 0.05

Hence, Our Preliminary studies confirmed the presence of heavy metals in all the 5 samples of mixed fruit Jams in Permissible levels. To our Surprise, since all the 5 samples showed the same concentration of the Heavy metals we authors were spurred and we regard the data to be very discouraging as the analysts

Research Article

from various laboratories refused to screen our samples at the first place and secondly and very importantly we were told that the data given is not in reality correct otherwise the authors would be in trouble if they had given the correct data and we if had presented the same elsewhere hence the analysts had given us the same data for all the samples in question.

As the edible Jams have become a part of daily diet especially children relish the taste of the same it would be deleterious to all humans in case the concentration of the heavy metals exceeds the standard permissible levels in the same.

Hence it's our Plea for the Scientific community to carry out further research with regard to heavy metals and artificial colorants in the jam samples and the authors further would suspect the very cause for the presence of heavy metals could be due to the various fruits used in jam processing since some plants also help in phytoremediation in taking up heavy metals from the contaminated soils as noted from few of the earlier reports.

Hence we authors strongly recommend a detailed research to reveal the nutritional facts of the Edible Jams at the earliest for the safe human consumption.

ACKNOWLEDGMENTS

We authors thank Prof. HP Puttaraju, Coordinator, Division of Biological Sciences, Bangalore University, Bangalore for the Constant Encouragement and the Support rendered during the Course of Our Studies.

REFERENCES

FDA (No Date). *Food and Drug Administration*. Available: www.fda.gov.

Mohammed A Radwan and Ahmed K Salama (2006). Market basket Survey for some heavy metals in Egyptian Fruits and Vegetables. *Food and Toxicology* **44** 1273-1278.

Wieslaw Bednarek, Przemyslaw Tkaczyk and Slawomir Dresler (2006). Content of Heavy Metals as a Criterium of the Quality of Strawberry fruit and Soil properties. *Polish Journal of Soil Science* **39**(2) Lubin, Poland.