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HEAVY METAL CONTAMINANTS IN CEREALS USED FOR THE HEALTH MIX PREPARATION

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Abstract

Metals and other elements are naturally present in food or can enter food as a result of human activities such as industrial and agricultural processes. Some metals which cause particular health effects to humans are: mercury (Hg), lead (Pb), cadmium (Cd), tin (Sn) and arsenic (As). Heavy metals, in general, are non- biodegradable, have long biological half-lives and have the potential for accumulation in the different body organs leading to acute as well as chronic toxic effects. The key objective of this study was therefore to estimate the heavy metal content (As, Cd, Pb, and Hg) in cereal used for health mix preparation. A total of 6 cereal grains (Fried gram, Maize, Millet, Ragi, Rice and Wheat) was assayed for heavy metal content using the Perkin Elmer Optima, 5300 DV, inductively coupled plasma optical emission spectrometer (ICP-OES). The results indicated that the mean of heavy metals Arsenic and Mercury were below detection limit (BDL) in all cereal grains analyzed. Pb was found in maize at 0.04 ppm and Cd showed the highest range in Maize (0.038ppm), Millet (0.003 ppm), Ragi (0.003 ppm) and Rice (0.003 ppm). The obtained results declared that concentration of major studied metals were exceeding than the below detection limit as per standards. Hence, proper controls are essential to ensure the safety of ingredients used in health mix preparation.

Key words: *Atomic absorption spectroscopy - heavy metals - cereals - BDL- health mix*

Introduction

Heavy metal contamination in food cannot be underestimated as these foodstuffs are important for human diet. The raw materials that is, the cereals which are used for the production of health mix are rich in carbohydrate and other dietary supplements. However, intake of heavy metal contaminated cereals may pretence a risk to the human health. Heavy metals naturally occur in the soil and water, but anthropogenic activities like industry and mining are the main cause of this pollution. Natural way of soil and water contamination of metals is from sources like volcanic eruption, weathering of rocks, leaching into rivers, lakes and oceans due to the action of wind. And anthropogenic that is human activities which also include industrial activities, fertilizer and pesticide application, and generation of municipal waste are deposited and buried in the soil. If the heavy metal concentration exceeds in food it may lead to many health problems in humans. There was an increasing growth of industry, which has resulted in a lot of waste going into drains, which contaminates rivers, streams, and local channels. These sources are important for irrigation (Cheng, 2003). Heavy metals present in the water while using for irrigation may also lead to soil and plant pollution (Muchuweti *et al.*, 2006). Increased use of chemical fertilizers and livestock and poultry manure can also lead to an increase in heavy metals such as Cd, Pb, Cu, and Zn in soils and plants (He *et al.*, 2005). Small amounts of these

metals (1 in 1,000,000,000,000) will make it into the water supply, but they are dangerous due to a phenomenon called bioaccumulation. Mercury is a toxic heavy metal which causes damage to the central nervous system. Lead and cadmium are also the most abundant toxic heavy metals, higher level of these metals will affect the health of individuals like, causing lung cancer and kidney dysfunction. Lead is fewer toxic as compared to cadmium. But the exceeding level may inhibit the enzyme functions in children. Arsenic can damage the roots of plant and inhibit the uptake of nutrients (Friberg, L et al., 1986). The main objectives of the present work was to focus on the analysis of heavy metals in cereals which is used as the raw material for the preparation of health mix an important carbohydrate source for human diet and in order to assure a significant improvement in food quality and safety.

Methodology

Collection of Samples

The raw materials such as Ragi, Millets, Maize, Rice, Wheat and Fried gram used as a base material for health mix production were collected from a commercial enterprises and their suppliers. They were further subjected to heavy metal estimation.

Preparation and Treatment of Samples

Cereals samples were dried at 80^0c for 12 hours. After drying the samples were grinded into a fine powder using a blender and stored in polyethylene bags, until used for acid digestion.

Acid Digestion and Metals Determination of Samples

From the dried cereals, 1.000±0.005 grams were weighed into a 100ml beaker. 7ml of concentrated nitric acid and 2 ml of 70% perchloric acid were added and was cover with a watch glass. Samples were digested in the hot plate to reach a final volume of 3-5 ml. Evaporating the solution to dryness can cause loss of more volatile elements(eg: As, Se etc). To avoid this 10-15 ml of water were added to the digested sample and filtered through the filter paper in the 50 ml volumetric flask. The volume were made up to 50ml using distilled water. And the digested samples were estimated for heavy metals by "Inductively Coupled Plasma Optical Emission Spectrometer" Perkin-Elmer Optima 5300 dual view ICP-OES.

Result

The samples collected from the market were subjected to the analysis. The samples were first digested and distilled water was used for dilution to avoid cross contamination from water and then taken for the evaluation in Perkin Elmer Optima, 5300 DV, ICP-OES. Heavy metals such as Arsenic (As), Cadmium (Cd), Mercury (Hg) and Lead (Pb) of are analysed. Wavelength of metals was set at different points based on the maximum

absorbivity. Element symbol wavelengths in nanometres (nm) for heavy metals are as below:

Heavy metals	Element symbol wavelength (nm)
As	188.979
Cd	228.802
Hg	253.652
Pb	220.353

Heavy Metal Contaminants in Cereals

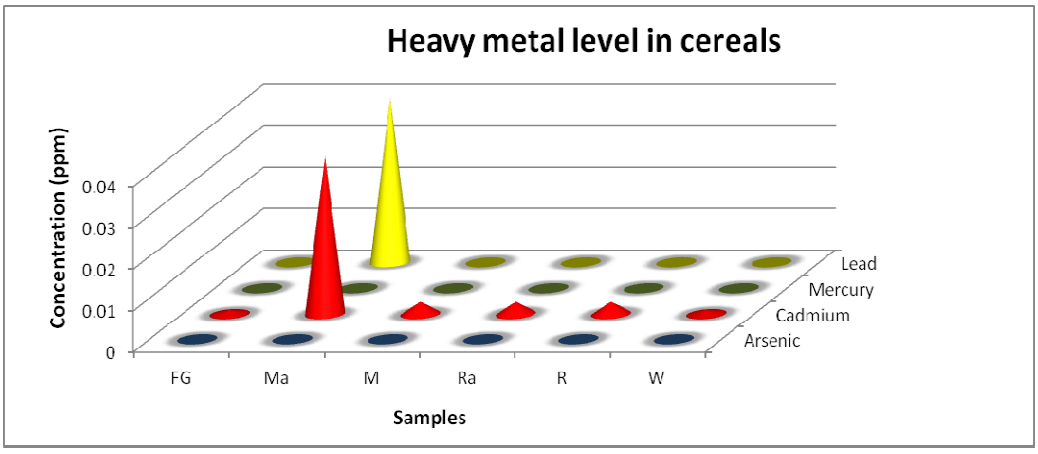
The mean and the standard error of the results were as represented in below table 1 and graph 1.

Table.1

Sl. No	Samples	Arsenic (ppm)	Cadmium (ppm)	Mercury (ppm)	Lead (ppm)
1	Fried gram(FG)	0	0.001±0.001	0	0
2	Maize(Ma)	0	0.038±0.004	0	0.04±0.001
3	Millet(M)	0	0.003±0.001	0	0
4	Ragi(Ra)	0	0.003±0.001	0	0
5	Rice(R)	0	0.003±0.001	0	0
6	Wheat(W)	0	0.001±0.001	0	0

Heavy metals were detected in six samples with 6 duplicates. Mainly the four heavy metals As, Hg, Pb and Cd were analysed. As and Hg was not detected in any samples. Pb was found only in maize and Cd shows the highest range of detection. It was found in four samples expect fried gram and wheat. The BDL of arsenic - 0.053 ppm, Cadmium - 0.002 ppm, Mercury - 0.061 ppm and Lead - 0.042 ppm. The graphical representation of the results were as below.

Graph.1



Discussion

As discussed in graph 1. the heavy metals were found to be present in minimum level in all the purchased samples. Cadmium was mostly found in the commercial products which is in concurrence with (Chandorkar *et al.*, 2013). The mean value of lead found in maize were 0.04±0.001 and the mean value of cadmium content in maize shows higher detection when compared to other samples. The mean value of heavy metal cadmium in maize were found to be 0.038±0.004, while millet, ragi and rice shows 0.003±0.001. The increased contaminants in maize may be due to the contaminants in soils and irrigation. Hence proper safety measures should be taken prior to the preparation of health mix. The arsenic and mercury content in all the purchased commercial products were found to be below detectable limit which is safer for the production of health mix.

Conclusion

Heavy Metal Content in cereal was analyzed and the results were referred with the BDL standards. The results of the heavy metals were found in some cereal samples. The results of these checks show that the levels of heavy metals in some cereals had exceeded the approval level. Furthermore cadmium were found in most samples, quality check should be considered before the production of health mix. Hence, proper controls are essential to ensure the safety of ingredients used for health mix preparation.

Reference

1. Cheng, S.P.2003. Heavy metal pollution in China: Origin, pattern and control. *Environ. Sci. Pollut. Res.*, *10*, 192-198.
2. Chandorkar Suneeta and Prachi Deota, Heavy Metal Content of Foods and Health Risk Assessment in the Study Population of Vadodara. *Current World Environ.* Vol. 8(2), 291-297 (2013).
3. Friberg, L., and C.G. Elinder 1986. "Cadmium and Health a Toxicological and Epidemiological Appraisal Volume I Exposure, Dose, and Metabolism." CRC Press, Inc.Boca Raton, FL.
4. He, Z.L.L.; Yang, X.E.; Stoffella, P.J. 2005. Trace elements in agroecosystems and impacts on the environment. *J. Trace Elements Med. Biol.*, *19*, 125-140.
5. Muchuweti, M.; Birkett, J.W.; Chinyanga, E.; Zvauya, R.; Scrimshaw, M.D.; Lester, J.N. 2006. Heavy metal content of vegetables irrigated with mixtures of wastewater and sewage sludge in Zimbabwe: Implications for human health.