

Exposure assessment of metals in human consuming wheat-based sweets: Risk Evaluation

In recent years, there has been a growing concern about the negative impact of unforeseen contaminants like metals in commonly consumed food items, posing a threat to human well-being. Therefore, it is of utmost importance to evaluate the levels of these contaminants to guarantee the safe consumption of these food items. Globally, controlling food contamination has become a significant issue, given the potential risks it poses to human health. The goal of the current research is to determine the levels of essential (EMs: Mg, Ca, Mn, Fe, Co, Cu, Zn) and potentially toxic metals (PTMs: Al, Cr, Ni, As, Cd and Pb) in various brands of conventional wheat-based sweets. Hundred samples were collected and analyzed by flame atomic absorption spectrometry (FAAS) and inductively coupled plasma-optical emission spectrometry (ICP-OES). Also, the current study was to investigate the distribution, correlation and multivariate analysis of 13 metals (Mg, Ca, Mn, Fe, Co, Cu, Zn, Al, Cr, Ni, As, Cd, and Pb). The accuracy of instrumental analysis of metals was guaranteed by analyzing the baking chocolate (SRM 2384).

The obtained metal concentrations were used to calculate the average daily intake (ADI), target hazard quotients (THQ), hazard indices (HI), carcinogenic risk (CR) and cumulative carcinogenic risk (CCR). The results also revealed that almost all sweet samples under evaluation had metal concentrations of Mn, Co, Pb, Cr, and Cd to be above WHO/FAO permitted levels. Estimated daily intake (EDI) of Ca ($7.47E-02$) and Cr ($2.05E-03$) were the highest among essential elements and potentially toxic elements respectively. THQ values were less than the threshold level i.e., <1 , whereas the HI values of several sweets were found to be above the threshold level i.e., >1 , which can lead to significant health hazards. CR values for Cu were in the range of $1.13E-04$ to $2.63E-04$ for several samples which is at the threshold level. Most of the sweet samples have CCR values in the range of 10^{-4} which is alarming when consuming the sweets for a long time. Therefore, it is a worrying condition that calls for attention to evaluate the production method and components used to make conventional Pakistani sweets since it can pose certain cancer concerns in the future.

This study highlights the importance of monitoring essential and potentially toxic elements levels and potential health risks associated with consuming contaminated wheat-based sweets.

Keywords: Food safety, Metal toxicity, Chemometric approach, Daily intake, Human health risk