

Exposure assessment of essential, and potentially toxic metals in human consuming wheat-based sweets:
Multivariate analysis and risk evaluation studies

In recent years, increasing concern has emerged regarding the presence of unexpected contaminants, such as metals, in commonly consumed food items, posing potential threats to human well-being. Evaluating contaminant levels is crucial to ensuring the safe consumption of these items, as global efforts to control food contamination have intensified due to associated health risks. This study collected and analyzed a hundred sweet samples using flame atomic absorption spectrometry (FAAS) and inductively coupled plasma-optical emission spectrometry (ICP-OES) 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 the metal analysis was confirmed by assessing baking chocolate (SRM 2384). Metal concentrations were utilized to calculate average daily intake (ADI), target hazard quotients (THQ), hazard indices (HI), carcinogenic risk (CR), and cumulative carcinogenic risk (CCR). Results indicated that most sweet samples exceeded WHO/FAO-permitted levels for Mn, Co, Pb, Cr, and Cd. The estimated daily intake (EDI) of Ca ($7.47E-02$) and Cr ($2.05E-03$) ranked highest among essential and potentially toxic elements, respectively. Although THQ values were below the threshold (<1), several sweets exhibited HI values surpassing the threshold (>1), posing significant health hazards. Alarming CCR values in the range of 10^{-4} was observed in many sweet samples, emphasizing the potential long-term health risks associated with their consumption. This study underscores the importance of monitoring essential and potentially toxic elements in wheat-based sweets and raises awareness about the associated health risks. These findings are critical for informing food safety regulations and promoting public health.

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