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ARTICLE

# Analysis of polychlorinated biphenyls in cream and ice cream using modified QuEChERS extraction and GC-QqQ-MS/MS method: A risk assessment study

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*The concentrations of six non-dioxin-like polychlorinated biphenyls (NDL-PCBs) were measured using the quick, easy, cheap, effective, rugged, and safe (QuEChERS) by gas chromatography (GC) coupled with triple-quadrupole (QqQ) tandem mass spectrometry (MS/MS) method in cream and ice cream offered in Tehran (Iran). The results showed the limits of detection, limit of quantification and recovery for the PCB analytes in the ranges 0.04–0.16, 0.132–0.482 ng/g fat, 5.2–9.2 and 95.5–107.2%, respectively. The results showed the mean concentration of total 6NDL-PCBs in cream (21.634 ± 2.18 ng/g fat) was higher than that in the ice cream (12.317 ± 1.524 ng/g fat) samples. The estimated daily intake (EDI) was lower than the tolerable daily intake (TDI < 10 ng/kg BW/day). Ultimately, the probabilistic model with Monte Carlo simulation (MCS) revealed the incremental lifetime cancer risk levels (95th) of PCB compounds in ice cream (adults = 1.62E–6 and children = 4.37E–6) and cream (adults = 9.65E–7 and children = 7.57E–6) were lower than the level of acceptable risk (10<sup>-4</sup>).*

**Keywords** Polychlorinated biphenyls, QuEChERS, GC-QqQ-MS/MS, Cream, Ice cream.

## INTRODUCTION

Today, in some countries of the world, due to overpopulation, food consumption is increasing. As a result, farmers have tried various ways to achieve more food production, including the use of pesticides (e.g. herbicide, insecticides). Herbicides are toxins that are easily converted to dioxins and in full at first use polychlorinated biphenyls (PCBs) and are widely used in agriculture (Jain and Ali 1997; Ali and Jain 1998; Ali and Aboul-Enein 2001, 2002; Basheer and Ali 2018; Al-Shaalan *et al.* 2019a; 2019b). Herbicides, dioxins and PCBs are toxic chemicals that persist in the environment and accumulate in the food chain. Among, 209 PCBs congeners known in nature, 6 NDL-PCBs (PCB-180, PCB-

153, PCB-138, PCB-101, PCB-52 and PCB-28) are considered as indicators of PCBs in food (EU 2011; Ahmadkhanliha *et al.* 2017; Saktrakulka *et al.* 2020a; 2020b).

These contaminants reduce the activity of the thyroid gland (decreased serum levels of Triiodothyronine (T3) and Thyroxine (T4), weaken the immune system, decrease the levels of vitamin A in the liver; they also cause liver necrosis, fatty liver disease and liver hypertrophy, inhibition of the synthesis of neurotransmitters such as dopamine and interruption in brain function such as learning and memory, estrogenic and androgenic hormonal changes (Alharbi *et al.* 2018; Cheney *et al.* 2019; Elangovan *et al.* 2019; Zhang *et al.* 2021). The World Health Organization (WHO) and the International

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