

UNIVERSITI TEKNOLOGI MARA

**RISK ASSESSMENT OF LEAD,
COPPER, MANGANESE, ZINC,
CADMIUM, AND IRON IN BLACK
TEA PRODUCTS SOLD IN
MALAYSIA**

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In the name of Allah, The Most Gracious, The Most Merciful

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ABSTRACT

Tea is the most popular beverage in the world that contains several essential nutrients which are beneficial to human health. In Malaysia, most consumers preferred black tea over other varieties of tea. However, several research carried out worldwide discovered the presence of heavy metals in black tea. Even at low concentrations, the presence of heavy metals in black tea raises concerns considering that they have a direct impact on human health. Therefore, this study aimed to evaluate the potential health risks associated with the heavy metals found in several commercial black tea brands in Malaysia. A total of 50 different commercial black tea brands were collected from the market, and the samples were analyzed for the concentration of 6 selected heavy metals using atomic absorption spectrophotometer (AAS). The results of AAS analysis showed that the level of Fe was 40.73-2.33 mg/kg, Zn was 12.48-5.15 mg/kg, Cu was 13.95-3.59 mg/kg, Mn was 22.85-3.27 mg/kg, Pb was 13.93-0.34 mg/kg, and Cd was 1.2-0.08 mg/kg. It was found that all metals had exceeded the permitted level of the Malaysian Food Act and Regulations and WHO/FAO except for Zn and Fe. This data was used in the calculation of Target Hazard Quotient (THQ) and Lifetime Cancer Risk (LCR) by using the formulas by USEPA 2011. From the calculations, it was found that several metals had THQ of more than 1 and Pb and Cd had LCR values of more than 10^{-6} . This indicates that the products can pose health and cancer risks to the majority of the population. As the black tea products sampled in this study can put the public's health at risk, prompt action is necessary where product recall is done for those that violated the heavy metal content limit. It is recommended that risk assessment and monitoring be done in black tea plant farms as well as during the tea productions production process to ensure the teas are safe for human consumption.

Keywords: *Black tea, heavy metals, Malaysia, health risk assessment, AAS*

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

The world's most consumed alcoholic-free, caffeinated beverage, tea is created from fresh tea leaves and steeped with boiling water to produce a tea infusion. The three species of *Camellia sinensis*, *Camellia assamica*, and *Cambodiensis* from the *Theaceae* family are used to make tea. China and India are the top two tea producers in the world, producing 2.6 million tonnes and 1.3 million tonnes of tea yearly in 2018, respectively. The USA is one of the top traders for tea, with an annual import value of over 487 million US dollars (Na Nagara, 2022). Drinking tea was deemed as beneficial to human health. Tea has several health benefits, including anti-inflammatory, antimutagenic, antioxidant, antibacterial, and cardiovascular disease prevention. According to a few researches that were done in the past, drinking tea will directly influence the uptake and accumulation of trace metals in the human body. Even though the beverage is regarded as a healthy, we should still be aware of its possibly hazardous consequences, which have hitherto gone unnoticed (Polechońska et al, 2016).

Tea plants can absorb heavy metals from the soil and build up large amounts of contaminants in their leaves and other edible portions. It has been discovered that the usage of pesticides and chemical fertilizers containing heavy metals, coupled with industrial operations as well as increasing industrialization and urbanization of agricultural regions, causes the soil in tea gardens to become more enriched with heavy metals like cadmium (Cd), lead (Pb), arsenic (As), chromium (Cr), mercury (Hg), Manganese (Mn), and copper (Cu) (Idrees et al. 2020; Kowalska. 2021; Maharramova. 2021). The most popular commercially available teas are black tea, which has been shown to have enormous health benefits, including meeting the body's needs for trace elements in the diet, acting as stimulants, lowering the risk of cardiovascular disease, assisting with weight management, having antioxidant properties, and controlling type II diabetes (Fred-Ahmadu et al., 2018). Suhaimee et al. (2020) mentioned that in