



## Levels of Heavy Metals and its Health Risk Estimation in Calyces of Red and White Roselles Purchased from Monday-Market, Borno State

A. I. Mohammed\*, A. A. Ahmed and Y. Shettima

<sup>a</sup> Department of Pure and Applied Chemistry, Faculty of Science, University of Maiduguri, P.M.B. 1069, Maiduguri, Borno State, Nigeria

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### ABSTRACT

Heavy metals accumulation in vegetables and their jeopardous health effects have been on increase especially after a long-term exposure. This study examines the levels of some heavy metals in calyces of red and white roselle obtained from Monday-Market, Maiduguri, Borno state, Nigeria. Furthermore, the study estimates the health risk associated with consumption of the calyces. The calyx samples were prepared in accordance with standard procedures and subjected to smart spectrophotometer for heavy metal analysis. The variation trend of the heavy metals in the red roselle was Cu > Zn > Cr > Cd while in the white roselle was Zn > Cu > Cr > Cd. However, Hg was not detected in both samples. The Health Quotient (HQ) calculated for the heavy metals showed that Cd and Cu were greater than unity indicating that consumers may be exposed to potential non-carcinogenic health risk due to Cd and Cu intoxication. The Target Cancer Risk (TCR) values ( $2.26 \times 10^{-4}$  -  $1.34 \times 10^{-1}$ ) recorded in the present study were all above the allowable range of  $1 \times 10^{-6}$  -  $1 \times 10^{-4}$  by United Nations Environmental Protection Agency (USEPA) indicating cancer risk through ingestion of these calyces. The risk of cancer among the metals for both samples followed the sequence Cu > Cr > Cd.

### 1. Introduction

Heavy metals contamination is a major problem of our environment and they are also one of the major contaminating agents of our food supply. The knowledge of metals in food is essential for assessing the dietary intakes of essential metals and human exposure to toxic elements [1]. The non-biodegradable nature, long biological half lives and their ability to proliferate in various body parts make heavy metals dangerous pollutant. Consumption of foods contaminated with heavy metals for a long period can lead to their accumulation in the kidney and liver of human beings resulting in different dysfunctions in many biochemical processes that could result in kidney, bone, cardiovascular and nervous diseases [2]. *Hibiscus sabdariffa* L. is known as roselle or red roselle in English, Karkade in Arabic, Karasu in Kanuri, Yakuwa in Hausa and Amukan in Yoruba languages of Nigeria. It is taken as a common local drink popularly known as zobo in Nigeria. It is cultivated for leaf, fleshy calyx, seed or fiber according to the respective properties of the two major varieties *var. rubber* (red) and *var. intermedium* (green).

The thick red and fleshy cup-shaped calyces of the flower are consumed worldwide as a cold beverage and as a hot drink (Sour tea) [3]. *Hibiscus sabdariffa* L. is also used in folk medicine against many complaints that include high blood pressure, liver diseases and fever [4,5]. In Nigeria, a decoction of the seed is given to augment or induce lactation in poor let down and maternal mortality [6]. The red colouring makes it popular ingredient of commercial herbal teas. In some places, its leaves are also used as a vegetable and its stem has a fiber that is sometimes used for domestic purposes. Seed of roselle are source of nutrition, protein and other beneficial elements [7]. The seed contains oil which is good as a lubricant fuel, and used for making soap. The physicochemical characteristics of roselle was studied and it was characterized as a highly acidic fruit with low sugar content. Succinic acid and oxalic acid were quantified as two predominant organic acids in roselle. Roselle was found to contain higher amount of ascorbic acid compared to orange and mango [8]. Figure 1 shows the aerial view of the red and white roselle plants.

The aim of the study was to examine the physicochemical properties and levels of some heavy

\* Corresponding author. email: [adnanimchem@yahoo.com](mailto:adnanimchem@yahoo.com)