



Human Health Assessment of Heavy Metals through Consumption of Vegetables from Some Agricultural Locations in Borno State, North East Nigeria

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ABSTRACT

The aim of this study was to determine the concentration and conduct risk assessment of heavy metals in some selected vegetables (tomatoes (*Solanum lycopersicum*), spinach (*Spinacia oleracea*), onion (*Allium cepa*), cabbage (*Brassica oleracea*) and lettuce (*Lactuca sativa*) from Gongolong and Alau Dam agricultural locations. The vegetable samples were digested and analysed using Perkin-Elmer A-Analyst 300 Atomic Absorption Spectroscopy (AAS). The concentration of the studied heavy metals in the vegetables exceeded the maximum permissible limits as specified by Food and Agriculture Organization/World Health Organization (FAO/WHO). Results from average daily intake (ADI) were below the provisional tolerance daily intake and are safe for human consumption. Hazard quotient (HQ) values for all the metals were less than the USEPA permissible limit of 1, and does not pose any serious health risk, except Cd and As from Gongolong agricultural location which indicate potential non-cancer health risk. HI values for Cd and As from Gongolong location and Cu, Ni, Cd, As and Pb were greater than the USEPA threshold limit of 1, indicating serious non-cancer health risk. The research therefore recommends regular check of heavy metals in vegetables be conducted so as to protect human health and the environment.

1. Introduction

Heavy metals can enter human body through inhalation, ingestion and dermal contact absorption [1, 2]. They also accumulate in soil, plants and in aquatic biota [3,4]. Heavy metals can persist for a long time within different organic and inorganic colloids before becoming available to living organisms [1, 5]. They are non-degradable and therefore do not decay with time. They have been growing concerned over the levels of heavy metals in vegetables as a result of irrigation using polluted water [6]. Heavy metals can pose health risk in animal and humans, and high levels of heavy metals in vegetables and other foods can cause bone marrow, renal, cardiovascular, psychosocial dysfunctions, gastrointestinal cancer, kidney and nervous system [7,8]. The sources of heavy metals in plants include contaminated water, fertilizer application, industrial waste, sewage disposal and pesticides application, also the contaminated vegetables consumed by man and other animals may cause several physiological problems [6,7]. Repot by [9,10] shows that vegetables contained some constituent such as protein, fibre, nutritional values,

antioxidants, carbohydrate, vitamin and minerals, and are important diet to human and animals. During digestion, vegetables in their forms act as neutralizing agent for acidic substances, and also have a firmness texture which are made of pectin substances and cellulose [9]. The occurrence and presence of heavy metals have been reported in various cities of the world in vegetables [8, 9, 11, 12,13, 14], rice [15], cereals [16]. Several methods have been used for determination of heavy metals as highlighted by [17, 18, 19] and food analysis [20, 21, 22, 23, 24]. Alau Dam and Gongolong agricultural areas have a long history of large scale production of vegetables for human consumption, as well as use of agrochemicals. Irrigation of vegetables is a common practice in Alau Dam and Gongolong agriculture areas. Various types of waste containing hazardous chemicals and toxic metals within the Maiduguri Metropolis are discharged directly into River Ngada. Vegetable farmers within the drainage line of river Ngada used the contaminated water for irrigation. Larger quantity of vegetables are harvested and sold in the markets within the city of Maiduguri, also report from different study have shown serious health problem arise from the accumulation of heavy metals

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