Metals health risk assessment via consumption of vegetables

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Abstract—Heavy metals pollution is one of the problems that arise due to the increased uses of fertilizers and other chemicals to meet the higher demands of food production for human consumption. Health risk assessment for heavy metals of the population is a very good technique because such assessment would be useful to give information about any threat regarding heavy metals contamination in vegetables. For health risk assessment different methods are used by different researchers. In this review paper different methods, for assessment of the heavy metals concentration in the human body contributed by contaminated vegetables, are discussed. These methods include the daily intake of metals (DIM), daily dietary index (DDI), provisional tolerable daily intake (PTDI), along with the methods used for the health risk assessment. The health risk assessment methods include hazard quotient (HQ) and health risk index (HRI).

Keywords—Risk assessment; Metals; hazard quotient; daily intake; Vegetables

I. INTRODUCTION

Food safety is a major public concern worldwide. The increasing demands for food and food safety has drawn the attention of researchers to the risks associated with consumption of contaminated foodstuffs i.e. pesticides, heavy metals and or toxins in vegetables [1, 2]. Heavy metals contamination is a major problem of our environment and they are also one of the major contaminating agents of our food supply [2, 4]. This problem is receiving more and more attention all over the world, in general and in developing countries in particular. The biological half-lives of these heavy metals are long and have potential to accumulate in different body organs and thus produce unwanted side effects [5-7].

Lead and Cadmium are the most toxic and the most abundant metals in food. Excessive accumulation of these heavy metals in human bodies creates the problems like cardiovascular, kidney, nervous and bone diseases [5, 8-10]. It is known that serious systemic problems can develop as a result of increased accumulation of dietary heavy metals such as cadmium and lead in the human body [11]. Heavy metals are extremely persistent in the environment; they are non biodegradable and non thermo-degradable and thus their accumulation readily reaches to toxic levels [12].

Heavy metals can impair important biochemical systems, constituting an important threat for the health of plants and animals. The adverse health effects of several chemical elements have been documented throughout history: Greeks and Roman physicians were able to recognize symptoms of acute lead and arsenic poisoning long before toxicology became a science. Currently, the advances of toxicology has improved our knowledge about human exposure to toxic elements and their health effects, such as developmental retardation, several types of cancer, kidney damage, endocrine disruption, immunological disorders (autoimmunity) and even death. Significant contamination of seeds, plants and plant products with toxic chemical elements due to human exposure to toxic elements and their health effects, such as developmental retardation, several types of cancer, kidney damage, endocrine disruption, immunological disorders (autoimmunity) and even death. Significant contamination of seeds, plants and plant products with toxic chemical elements due to contaminated soil and water has been observed as result of release of these toxicants into the sea, rivers, lakes and even into irrigation channels. Afterwards, the consumption of contaminated vegetables constitutes an important route of animal and human exposure. The tradition of growing vegetables within and at the edges of cities is very old [13]. It should be realized that most of these cultivated lands are contaminated with heavy metals contributed mainly through vehicular emissions, pesticides and fertilizers, industrial effluents and other anthropogenic activities. These contaminated soils have resulted in the growth of contaminated vegetables [14-16].

Heavy metals in soils reduce the yield of vegetables because of disturbing the metabolic processes of plants [17,