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Mini Review

Domination of Pollutant Residues Among Food Products of South-East Asian Countries

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Abstract

Southeast Asia is a region that produces high amounts of key food commodities and includes areas of divergent socio-economic status. Food security is a high-priority issue for sustainable global development both quantitatively and qualitatively. In recent decades, adverse effects of unexpected contaminants on crop quality have threatened both food security and human health. Public concern about the adverse environmental and human health impacts of organochlorine contaminants led to strict regulations on their use in developed nations two decades ago. Nevertheless, DDT and several other organochlorine insecticides are still being used for agriculture and public health programs in developing countries in Asia and the South Pacific. As a consequence, humans in this region are exposed to greater dietary levels of organochlorines. Heavy metals and metalloids (e.g., Hg, As, Pb, Cd, and Cr) can jeopardize human metabolomics, contributing to morbidity and even mortality. Those during crop production include soil nutrient depletion, water depletion, soil and water contamination, and pest resistance/outbreaks and the emergence of new pests and diseases.

Keywords: Pesticides; Cancer; Organochlorine Insecticides; Heavy Metal Poisoning; Fertilizers; Food-Processing Operations

Abbreviations

PAHs: Polycyclic Aromatic Hydrocarbons; POPs: Persistent Organic Pollutants; PFCs: Per-Fluorinated Compounds; PPCPs: Pharmaceutical and Personal Care Products; IFPRI: International Food Policy Research Institute; MEP: Ministry of Environmental Protection.

Figure : South/Southeast Asian countries (Modified from asiasociety.org).

Growth in global population means that farmers must produce food for an estimated 9.1 billion people expected to inhabit the earth by 2050 [1]. Globally, there are over 50,000 edible plants. Just three of these (rice, maize and wheat) provide about 60% of the world's food energy intake [2]. The countries of South and Southeast Asia span an area of about 9.75 million km2 and have a population of 2.4 billion. According to Sabir., *et al*. 2017 they represent almost 30.66% of the world's population in only 6.57% of the world's land area [3]. According to World Bank, South Asian countries are home to home to 33% of the world's poor and economies have among the highest levels of public debt in the world [4]. Mean consumption of whole grains was 38.4 g/day in between 1990 to 2010. Southeast Asian nations along with 2/3 Sub-Saharan African regions had the highest intakes. Overall, 23 of 187 countries had mean whole grain intake ≥2.5 (50 g) servings/day, representing 335 million adults and 7.6% of the world adult population [5]. Southeast Asia is a region that produces high amounts of key food commodities and includes areas of divergent socio-economic status. The major grain crops produced in the region are rice and maize [6]. The potential sources for the contamination of grains

are mostly environmentally based and include air, dust, soil, water, insects, rodents, birds, animals, microbes, humans, storage and shipping containers, and handling and processing equipment [7]. Contamination by chemicals from the environment include metals/metalloids, polycyclic aromatic hydrocarbons (PAHs), persistent organic pollutants (POPs), per-fluorinated compounds (PFCs), pharmaceutical and personal care products (PPCPs), radioactive elements, electronic waste, plastics, and nanoparticles [8]. At same time, agricultural land has been used for estate or factory development resulting in pollution of the land and water [9]. In managed ecosystems such as those in cultivation for food crops, on the other hand, conditions are often manipulated to maximize crop yields through irrigation and fertilization [10]. Research has clearly identified environmental harm from the presence of micro-pollutants in soils, groundwater and surface water. Surface water was found to be more contaminated than ground water with a greater number of and more concentrated pesticides (organochlorines and organophosphates) [11]. Plants are the world's major source of food. These plants are susceptible to 80,000 to 100,000 diseases caused by everything from viruses to bacteria, fungi, algae, and even other higher plants [12]. Humans cultivate only about 150 of an estimated 30,000 edible plant species worldwide, with only 30 plant species comprising the vast majority of our diets [13]. Again, Food plants have to compete with some 30,000 different species of weeds worldwide, of which at least 1800 species are capable of causing serious economic losses [14]. Globally, around 20–30% of agricultural produce is lost annually due to insect pests, diseases, weeds and rodents, viz, growth, harvest, and storage [15,16]. The rates of destruction often are higher in less developed nations and they are now accounting for a quarter of the world's pesticide use [14,16]. Therefore, judicious use of pesticides plays a major role in plant protection. Farmers habitually apply fertilizers and hazardous insecticides in high quantities without assessing the actual field requirements due to inadequate knowledge [1,15,17]. Since pesticides are directly applied on crops, fruits, and vegetables in most agricultural applications, infants, children, and adults can be exposed to pesticides by the ingestion of those pesticide-contaminated foods [18-22]. Pesticides can exist in residential air by the evaporation of volatile and semi-volatile pesticides, such as organochlorine pesticides, from crops and residential surface soil [23-26]. Soil is an important source for heavy metals (like mercury/cadmium) in crops and vegetables since the plants' roots can absorb these pollutants from soil, and transfer them to seeds [27,28]. According Retamal-Salgado., *et al*. 2017 cadmium (Cd) distribution in the different plant organs, more than 40% of Cd is absorbed and translocated to the aerial part of the plant (grain and straw), and it could be directly (grains) or indirectly (animals) ingested and negatively affect humans [29]. It accumulates in the liver and kidneys for more than 30 years and causes health problems. Toxicity of this metal involves kidney and skeletal organs and is largely the result of interactions between Cd and essential metals, such as calcium [30-34]. Hassan., *et al*. 2017 says increased prevalence of diabetes in South Asia may be related to the consumption of arsenic contaminated rice depending on its content in the rice and daily amount consumed [35]. Sabir., *et al*. 2019 demonstarted that arsenite can bind covalently with sulfhydryl groups in insulin molecules and receptors, enzymes such as pyruvate dehydrogenase and alpha keto-glutarate dehydrogenase, and glucose transporters (GLU-T), which may result in insulin resistance [36]. According to Kumar., *et al*. 2017 50%-60% cereal grains can be lost during the storage stage due only to the lack of technical inefficiency. Use of scientific storage methods can reduce these losses to as low as 1%-2% [37]. Factors like increasing climatic variability, extreme weather events, and rising temperatures pose new challenges for ensuring food and nutrition security in Asian region. The South Asian region is one of the least integrated regions according to Washington based-International Food Policy Research Institute (IFPRI) [38]. China feeds 22% of the world population with 7% of the worlds arable land. Sodango., *et al*. 2018 reported that 20 million hectares (approximately 16.1%) of the total arable land in China is highly polluted with heavy metals, according to Ministry of Environmental Protection (MEP), China [39]. It is estimated that between 900,000 and 1,360,000 kg arsenic per year was introduced into Bangladesh soil through contaminated groundwater used for irrigation [40]. Pajewska-Szmyt., *et al*. 2019 reported that maternal exposure to heavy metals as Pb or Hg and persistent organic pollutants were associated with children neurodevelopment delay and also indirectly affects reproductive, respiratory, and endocrine system [41]. The US Centre for Disease Control and Prevention confirmed more than 11,000 foodborne infections in the year 2013, with several agents like viruses, bacteria, toxins, parasites, metals, and other chemicals causing food contamination [42]. Widespread agricultural use of pesticides and home storage make them easily available for acts of self-harm in many rural households. Stability of organophosphorus pesticides are also important issue [43]. It was found that malathion was more unstable than dichlorvos and diazinon, there was an over 70% loss in 90 days even at -20 °C in coarsely chopped form [44]. It could be another reason for haphazard use of pesti-

cides in the field and stored food commodities [45]. Around 600 million food borne illnesses and 420,000 deaths occur each year due to poor food handling practice. Such contaminants get access to contaminate food mainly due to food handler's poor knowledge and negligence during handling activities [46,47]. The washing with water or soaking in solutions of salt and some chemicals e.g. chlorine, chlorine dioxide, hydrogen peroxide, ozone, acetic acid, hydroxy peracetic acid, iprodione and detergents are reported to be highly effective in reducing the level of pesticides [48]. Various food-processing operations include sorting, trimming, cleaning, cooking, baking, frying, roasting, flaking, and extrusion that have variable effects on mycotoxins [49]. Cooking rice in excess water efficiently reduces the amount of arsenic (As) in the cooked grain [50].

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Conflict of Interest

The author declares that he has no competing interests.

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