

The Persistent Organic Pollutants (POPs) in Animal Tissues

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Abstract

The POPs residues that remain in the tissues of animals and enter the food chain considered as public health threats to consumers. Therefore, several studies and surveys carried out with the aim of simultaneous determination of the levels of some POPs residues including organochlorine pesticides (OCs) and the polychlorinated congeners (PCBs) in animal tissues especially the meat and meat products. The residues compared with Maximum Residual Limits (MRLs) established by the international health regulatory agencies. The residues of different compounds compared with MRLs of different international regulations as the EU MRLs as a basic choice of comparison for the following reasons: first, the European Commission fixes MRLs for the vast majority of chemical residues in meat. Second, the EU has the lowest MRLs among the other regulation, and sometimes there is a gap between the MRLs of EU and other regulations.

The aim of the present review tried to light about the significance of the POPs residues, including OCs pesticides and polychlorinated congeners in animal products. And to assess the situation of Maximum Residual Limits (MRLs) established by the different international health regulatory agencies concerning Egyptian regulations.

Keywords: POPs; Organochlorine Pesticide; Polychlorinated Biphenyls; Residues; Animal Tissues

Introduction

Today, environmental pollution is considered as one of the most serious problems in the world [1]. The main concern is that they may be present in the feeds consumed by farm animals and thus contaminate the resulting meats [2]. Meat and meat products are important for nutrition and the human diet but are also one of the major routes of human intake of contaminants [3].

Persistent organic pollutants (POPs)

Persistent organic pollutants (POPs) are toxic chemicals that persist in the environment and biomagnify in the food chain. Organochlorine pesticides and polychlorinated biphenyls represent important groups of POPs, which have caused worldwide concern as toxic environmental contaminants [4]. POPs are ubiquitous contaminants and have been detected far from their sources of origin because of long-range transport stemming from the atmospheric exchange, water currents, animal migration and other pathways [5].

POPs characterized by their lipophilicity, semi-volatility and resistance to degradation. These characteristics pre-dispose these substances to long environmental persistence and long-range transport. Due to their toxic characteristics, they pose a threat to humans and the environment [6].

Farmers widely use OCs because of their effectiveness and their broad-spectrum activity [7]. OCs are synthetic organochlorines which are lipophilic and hydrophobic. OCs' lipophilicity, hydrophobicity, stability to photo-oxidation, and low vapor pressure, and low chemical and biological degradation rates have led to their accumulation in biological tissues and the subsequent magnification of concentrations in organisms, progressing through to the food chain [8]. Live-stock meat and dairy products are a primary source of human dietary exposure to organochlorines [9].

(PCBs) are a family of human-made organic chemicals [10]. They consist of 209 congeners differing either in physicochemical properties or in toxicological response [11]. Consumption of fish is a common source of PCB exposure, but other foods with lower PCB levels that are consumed more frequently, including meat, dairy, and poultry products, also contribute to PCB exposure [12].

Although most countries have prohibited PCBs production, a considerable amount of these compounds are still in use [13]. Today PCBs can still be released into the environment from poorly maintained hazardous waste sites that contain PCBs, illegal or improper dumping of PCBs' wastes; leaks or releases from electrical transformers containing PCBs; and disposal of PCB-containing consumer products into municipal or other landfills not designed to handle hazardous waste. PCBs may also be released into the environment by the burning of some wastes in municipal and industrial incinerators [14].

International agencies

To protect consumers from POP-contaminated food, many national and international agencies such as the European Food Safety Authority (EFSA), World Health Organization (WHO), US Environmental Protection Agency (EPA) and US Food and Drug Administration (FDA) have developed regulations and guidelines to reduce the exposure to POPs [15].

The dominated governmental agencies and regulations responsible for MRLs are many international organizations such as the Codex Alimentarius Commission (CAC), WHO/FAO, and European Union (EU), as well as different countries, have issued their own pesticide maximum residual limits in the international trade (Lin, 2002).

Pesticides are tested and approved for use by the U.S Environmental Protection Agency (EPA) [16]. Moreover, the U.S. Food and Drug Administration (FDA) is responsible for monitoring pesticide levels on fruits and vegetables, while the U.S. Department of Agriculture (USDA) charged with surveying pesticide residues in meat, eggs and dairy products [17]. The Food Safety and Inspection Service (FSIS) is the public health agency in the U.S. Department of Agriculture responsible for ensuring that the nation's commercial supply of meat, poultry, and egg products is safe, wholesome, and correctly labeled and packaged. The Food Safety and Inspection Service (FSIS) in its regulatory programs apply chemical residue limits set by the Environmental Protection Agency (EPA) [18].

The Japanese Positive List System is designed for Agricultural Chemical Residues in Foods in Japan and it is established in 2006 by MHLW (The Japanese Ministry of Health, Labour, and Welfare). MHLW introduced a new system for the regulation of pesticides, feed additives, and veterinary drugs which is a "Positive List System." The majority of the chemicals under the regulation are pesticides, and their residues are most often measured by gas or liquid chromatography with mass spectral detection (GC/MS or LC/MS) [19].

National MRLs standard in Egypt

Egypt does not make a national MRLs standard, but according to article 1 of the ministerial decree No. 864 of the year 2009 of the Egyptian Ministry of Agriculture considering the determination of MRLs of pesticides, it defers to Codex regulations. If Codex does not list an MRL, Egypt follows the European Union's MRL standards (including the default MRL policy). If the EU does not list an MRL or default MRL, then United States MRL standards are used [20].

It is worth mentioning that on 17/05/2002, Egypt signed the convention on Persistent Organic Pollutants (POPs) and ratified it in 2003 joining forces with more than 100 countries to support and implement groundbreaking United Nations treaty in Stockholm which known as Stockholm convention. Egypt, as well as other countries, agrees to reduce or eliminate the production, use, and release of 12 keys POPs which are Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, Mirex, Toxaphene and PCBs beside Dioxins and Furans [21].

The European Commission (EC) fixes MRLs for all food and animal feed marketed within the European Union. The Regulation covers pesticides currently or formerly used in agriculture in or outside the European Union (EU). Where a pesticide is not specifically mentioned, a general default MRL of 0.01 mg/kg applies. Codex MRLs are used as guidance on acceptable levels but are only relevant within the European Union, where they apply to a commodity for which EC statutory MRLs are not set [22].

Conclusion

In conclusion, it should be a continuous program designed for analyzing and monitoring meat and meat products in the local markets before using to make sure that the levels of pesticide residues don't exceed the MLR. Also, the usage of banned pesticides should be stopped. Besides, the developed countries like Egypt should apply a training program to the farmers and show them the hazardous effects of using such banned pesticides or even using pesticides higher than the recommended doses. At the regional level (i.e. African Countries), a strategic plan for monitoring and getting rid of POPs in the continent should be set up and implemented through coordination between all governments. Among issues of top priorities are to find alternative non-combustion technologies for disposing obsolete pesticides and to use alternative control measures for mosquitoes' management and other vector-borne diseases.

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