TOXIC EFFECTS OF PESTICIDE RESIDUES ON WARM-BLOODED ANIMALS INCLUDING HUMANS, IN KENYA

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ABSTRACT

The celebration of the World Food Safety Day every 7th of June has been held seven times on a global level since its establishment by the United Nations General Assembly on 20th December 2018. Kenya has celebrated this day since its set-up, and it has gained momentum in 2023 and 2024. The nationwide campaign introduced in the past two years through media house engagement, collaboration with development partners, government agencies, trade blocks, the academia, research and private institutions to discuss and promote food safety, raise awareness and influence policy and practice in addressing food safety issues, is a clear indication that Kenya is on the right path to addressing food quality and safety issues. Conversely, the year that the World Food Safety Day was set up, just under ten years, is an indicator of how long overdue the subject of addressing food safety at a global scale is, albeit at national levels.

The widespread use of pesticides has led to concerns about potential risks posed by their residue in food products. This review focuses on the effects of pesticide residues on warm-blooded animals, including humans in Kenya, emphasizing the importance of monitoring pesticide residue in the food chain to establish safe levels for better health and nutrition.

INTRODUCTION

Food quality and safety in Kenya is a topic that the government has gone to great lengths to address over several years through reviewing existing regulatory frameworks. A new Bill proposed in 2023, The Food and Feed Safety Control Co-ordination Act, lists ten competent authorities that provide for the *coordination of the public institutions in the control of food and feed safety; to establish the Office of the Food Safety Controller; to provide for the role of County Governments in food and feed safety; and for connected purposes*. The authorities include the ministry responsible for public health and medical services, the ministry responsible for veterinary services, crop development and livestock development, the ministry responsible for fisheries, the Agriculture and Food Authority, The Kenya Dairy Board, The Kenya Plant Heath Inspectorate Service, The Pest Control Products Board, The Fertilizer and Animal Foodstuff, Board The National Biosafety Authority and The Kenya Bureau of Standards.

In Kenya, food safety has notable challenges for public health and economic development with significant factors such as limited human and technical capacity in regulatory enforcement and the ever-present informal markets hindering government efforts to improve the status quo. More specifically, the issue of maximum residue limits of pesticides and veterinary drug residues in food and feed products remains a big challenge.

PESTICIDE RESIDUES IN FOOD AND FEED PRODUCTS

The agriculture sector in Kenya accounts to 27% of the GDP and 80% of the rural population depend on subsistence farming as source of food, employment and income (Marete et, al., 2021). Kenya's agricultural use of pesticides has been on a steady increase in the past decade. This is driven by the demand for more food supply for a growing population of over fifty-five million people (World Bank Group Open Data, 2023). Most of the food produced in a conventional farming system in Kenya rely heavily on pesticides to control various pests, weeds and fungal disease with leading food products being maize, wheat, coffee, potatoes and tomatoes in western, the Rift and central areas (Pesticide Atlas, 2022).

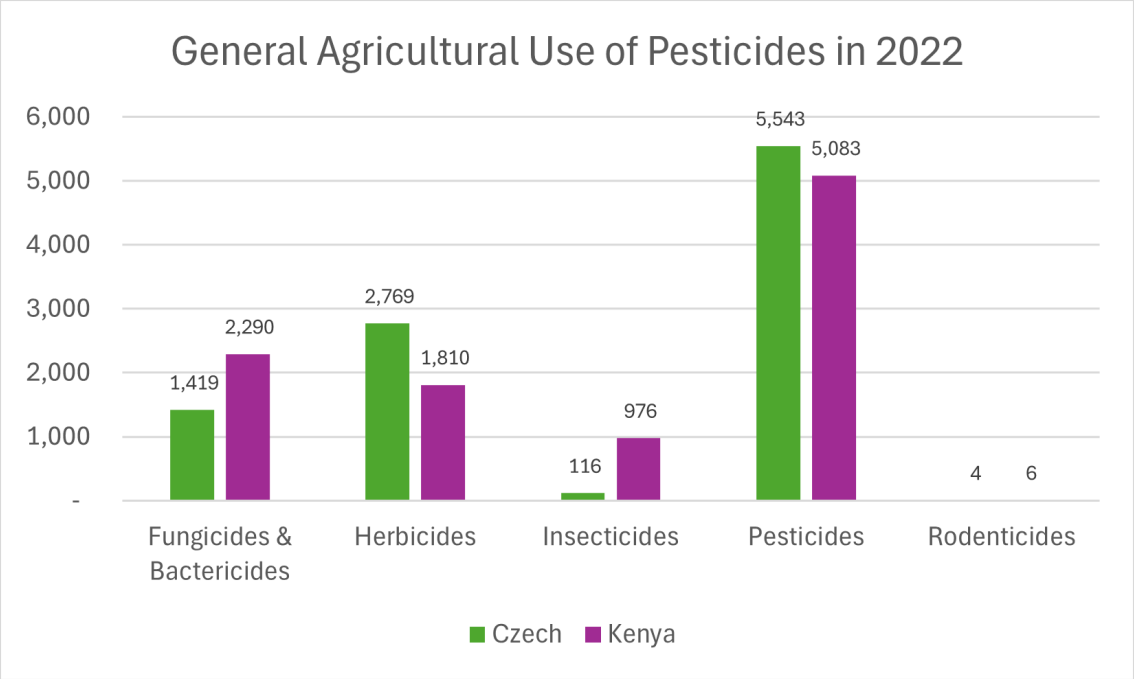

Figure 1: Agricultural use of pesticides in 2022 between Czechia and Kenya in metric tons (FAO, 2022).

Pesticides are a key agricultural input needed to protect seeds and safeguard crops from unwanted plants, insects, bacteria, fungi and rodents. At the same time, pesticides can have negative health and environmental impacts through contamination of soil, water and non-target plants and animals, which can decrease biodiversity and harm living organisms including humans (FAO, 2021). Pesticide residues can enter the food chain in various ways even though they are directly applied to soils where they meet with non-target organisms and accumulate in the body tissues of organisms to cause more health problems (Kumar et al., 2021).

The Pest Control Product Board in Kenya (PCPB), is mandated to control the exportation and importation, manufacture, distribution and use of pest control products. PCPB has accredited over 70 institutions in the country. Between 2021 and 2023, PCPB deregistered 84 Pest Control Products (PCBs) including fungicides, rodenticides, herbicides, insecticides, miticides, fumigants, manufactured in Germany, Netherlands, China, USA and France. These PCPs had active ingredients above the required standards. In one selective post-emergence herbicide product for the control of broadleaf weeds in wheat and barley manufactured in France, it was found to have bromoxynil 120g/L + Ioxynil 120g/L + pecoprop-P 360g/L.

In contrast, the European Union maximum residue levels (MRLs) for the components are, Bromoxynil- 0.05mg/kg ; Ioxynil- 0.01mg/kg and Mecoprop-P- 0.05mg/kg with the restricted entry interval (REI) at 24hours for wheat and World Health Organization pre-harvest interval (PHI) at 75days and classed as Moderately hazardous (Class II) on the Yellow Colour Band.

Due to governance, legal and control setbacks that Kenya faces, the amount of toxic pesticide products entering the market and used across the food chain can be challenging to trace and account for. In 2020, The Expert Committee on Pesticide Residues in Food (PRiF) Report on the pesticide residues monitoring programme, Quarter 1 2020, shows that export of fine beans from Kenya was rejected for having high levels of acephate, hexaconazole and methamidophos.

Effects of Pesticide Residues in Warm Blooded Animals including Humans

Acute Pesticide Poisoning (APP) is an ongoing major global public health challenge. Study results point to a heavy burden on non-fatal Unintentional Acute Pesticide Poisoning (UAPP), particularly for farmers and farm workers, with about 385 million cases and 11,000 deaths per year. (BMC Public Health 2020). Poisoning from pesticide residue happens across the agri-food chain from planting, harvesting, processing, packaging and selling in an intended and unintended manner.

Residues can enter the body of animals and humans orally by ingesting the pesticides or through contaminated water or food like fresh fruits and vegetables that have not adhered to the PHI window. Pesticides sprayed on to fields and used to fumigate soil can give off volatile organic compounds, which can react with other chemicals and form a pollutant toxic in the ozone layer and absorbed through the nose by inhalation of toxins in the air. Pesticide use accounts for about 6 per cent of total tropospheric ozone levels. Volatilization may lead to the inhalation exposure of toxic chemicals which lead to many health problems (Kariuki, 2017). Pesticide residues can also enter the human and animal body by absorption through the eyes and dermal by absorption through the skin. Poisoning in humans can last hours to days in the short-term and can cause stinging eyes, rashes, blisters, blindness, nausea, dizziness and diarrhea. Long-term and chronic effects can cause cancers, birth defects, reproductive harm, immunotoxicity, neurological and developmental toxicity, and disruption of the endocrine system (Agot, et al., 2021). If patients don't respond to treatment, death happens (Hashimi et al., 2020).

Animals can gather pesticide residues from contaminated feed and water which in turn affects the meat, eggs and milk produced. In females, poor reproductive behavior, infertility, pregnancy loss, growth retardation, intra-uterine fetal demise and ovarian failure can occur (Choudhary et.al, 2018). Wildlife and other animals may face loss of critical food sources, leading them to migrate, alter their diet, or face the risk of starvation and death. While veterinary medicines are important in improving animal welfare and controlling animal health risks, issues like Anti-Microbial Resistance (AMR) can lead to deaths of animals and humans (WOAH, 2025).

Preventive Measures

The food safety management practices used when growing and preparing foods for sale are based upon scientific principles and increased awareness must be considered. The goal of these practices is to decrease the likelihood of food contamination with harmful foodborne pathogens, or to inhibit bacterial food borne pathogens from growing on the food prior to consumption (Harrison, 2017).

The government of Kenya should have an innovative, integrated and coordinated approach pest control program (Newslow, 2014). Workers in the food processing sector in Kenya should be trained on standards, policies and practices of food safety and the same be communicated to the management system requirements throughout all levels. For example, the Hazard Analysis and Critical Control Point (HACCP) program. Suppliers or vendors in the food chain should apply compliance requirements to critical food safety and quality by providing ingredients, packaging material, product contact/processing aids and incorporate traceability documentation to help create awareness to consumers so they know what products are in their food and how it ends up safely at the point of purchase.

Kenyans also have and individual responsibility to contribute to food safety by raising questions and commenting about the appropriateness of food control standards. It is important that all affected industry members know their obligations so that they can comply. It is also important that consumers know what steps are being taken on their behalf to prevent misconceptions (FAO 2024). In a study conducted on consumer pesticides concerns in 5 countries, Kenya included, almost 60% of the consumers in the sample from Kenya had pesticide-related food safety concerns (Justice et al., 2024).

The Government of Kenya needs to continuously audit industry performance to ensure compliance and uniform application of set standards. This involves regular training of inspection personnel so that they have a good understanding of the technologies and processes involved, as well as conducting inspections in an even-handed and fair manner.

CONCLUSION

The widespread use of pesticides has led to concerns about potential risks posed by their residue in food products. The establishment of MRLs by the government is essential to ensure the safety of consumers (Asamba, 2023). This review focused on the effects of pesticide residues, emphasizing the importance of monitoring pesticide residue in food to establish safe levels and attain the Food and Agriculture Organization of the United Nations' four betters; better production, better nutrition, better environment and better life.

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