

Food Safety in Tomatoes Produced in Laikipia County

POLICY BRIEF | APRIL 2020

Lydia Gatare¹, Vivian Hoffmann², Mike Murphy², Phoebe Scollard²

Key Findings

- **High prevalence of heavy metal contamination in tomatoes**

Over 50% tomato samples collected in Laikipia county contained lead in excess of WHO limits, threatening the brain development of young children; 24% exceeded EU standards for cadmium, which increases cancer risk.

- **Inadequate sanitation facilities**

89% of tomato farmers surveyed and 67% of retailers did not have a toilet facility with soap available for handwashing. Inadequate hygiene can lead to microbial contamination of produce, transmitting diarrheal and other diseases.

- **Information gaps**

Only 10% of surveyed farmers had received training on food safety, and 2% had had produce tested for hazards and received results in the past 12 months. No intermediaries or retailers had been trained or had produce tested.

Policy Recommendations

- **Identify and address sources of heavy metal pollution**

The National Environment Management Authority (NEMA), together with county authorities, should investigate sources of heavy metal pollution and enforce regulations to reduce human exposure.

County governments should test irrigation water and soil and inform farmers of results. Contaminated water and soil should be treated or remediated if possible, and otherwise disallowed for use in irrigation.

- **Provide advice on sanitation and monitor compliance**

Regulations on toilet and handwashing facilities are in place, but compliance is low. County governments should provide advice to food handlers on best practices for sanitation and hygiene, and monitor to ensure compliance.

¹Independent consultant, ²International Food Policy Research Institute

Background

Kenya is one of the main producers of tomato within Africa south of the Sahara, with an estimated market value of USD 237 million as of 2012. Tomatoes are vulnerable to a number of pests. As a result, pesticides are commonly applied to tomato in Kenya.^{a,b} The fleshy nature of tomato means that chemicals can easily soak into the edible part of the crop, leading to potentially high residual levels of pesticides.^c

The soil in which tomatoes are grown, and water with which they are irrigated, also affects food safety. Heavy metal contamination of the environment may arise through industrial effluent, disposal of household waste, disintegration of lead-based paint into the environment, and previous use of pesticides containing heavy metals in growing sites.^d As tomato is frequently consumed raw, contamination with disease-causing microbes also poses a significant food safety risk.^e

Data Collection

Data was collected from a sample of 210 farmers growing tomatoes within Laikipia County. The research team identified 7 wards within the county and carried out a census of tomato growers in these areas. Data from the census was used to sample farmers growing tomatoes on a variety of land sizes who then participated in household interviews.

In the course of the interviews, farmers were asked to provide contact information for intermediaries or retailers to whom they sold tomatoes. These individuals were then contacted and interviewed, with intermediaries similarly asked to provide details on retailers to whom they sold tomatoes. In this way a dataset was constructed on the tomato value chain originating in Laikipia, including intermediaries and retailers based outside the county.

Findings

Heavy metal and pesticide contamination

For 46 randomly selected survey respondents (42 farmers, 4 retailers), 1 kg samples of tomatoes were purchased, and laboratory analysis was carried out to assess the level of contamination with lead and cadmium.

Table 1- Share of tomato samples with metals exceeding limits

	Lead > WHO limit (0.3mg /kg)		Cadmium > EU limit (0.05 mg/kg)	
	Mean [95% CI]	N	Mean [95% CI]	N
Samples at farm and retail	0.50 [0.35, 0.65]	46	0.26 [0.13, 0.39]	46

55% of farmer samples (0 of 4 retailers) were found to have lead levels exceeding the WHO limit of 0.3mg/kg. Lead poisoning is a serious health risk which affects brain development and function. Exposure to lead is a particular risk for children, and regarded as unsafe at any level.^f Cadmium was also found to be above the limit specified by the EU in approximately one quarter of tests (including 2 of 4 retailers). Exposure to cadmium can lead to cancer, as well as kidney disease and damage to bones and the respiratory system.⁹

Tests for pesticide residues were carried out on 61 tomato samples. 39% of samples tested positive for at least one pesticide, but none of the samples had residue levels above the maximum level allowed by the European Union.

Microbial contamination

Microbial contamination refers to the introduction of pathogens and parasites such as bacteria, viruses, and the eggs of intestinal worms. This can occur at various stages of the value chain, from the farmer’s field through to vendor sales. Contamination can occur via soil through inadequately composted manure, or through untreated irrigation water. All farmers in our sample practice irrigation– primarily through furrow (or “flood”) irrigation– however only 6% reported having tested their water in the past 12 months, with only 3% reporting treating their water.

Table 2- Sanitation facilities

	Farmers		Intermediaries		Retailers	
	Mean	N	Mean	N	Mean	N
Facility has toilet	0.84	210	0.56	41	0.74	23
Hand-washing facility available	0.30	210	0.27	41	0.57	23
Hand-washing facility with soap available	0.11	210	0.15	41	0.43	23

Another transmission point for microbial contamination is contact with fecal matter on the hands of food handlers who have not practiced proper hygiene after using the bathroom. This can occur at any stage of food handling. While most of those surveyed indicated that workers had access to a toilet, only 11% of farmers and 43% of retailers were able to show the interviewer a handwashing facility equipped with soap.

Access to information

A key finding of the survey was that value chain actors lack information, both in terms of knowledge of good practices for food safety and the contamination status of their produce. Only 10% of farmers surveyed reported having been trained in food safety, and none of the intermediaries or retailers who participated reported having received such training.

Interactions with regulators were similarly limited: 3% of farmers and 6% of intermediaries and retailers reported having facilities inspected in the past 12 months. 3% of farmers reported having produce tested in the last 12 months, of which only half received the results of the test. None of the intermediaries or retailers interviewed reported having produce tested in the past 12 months.

Discussion

Our findings indicate that a significant share of tomatoes produced by farmers in Laikipia County are contaminated with heavy metals. Coordinated action by National Environment Management Authority, the Ministry of Agriculture Livestock and Fisheries, the Ministry of Health, and county governments is required to identify the source of this contamination. Contaminated soil or water sources should be remediated or not used for agricultural production.

Action is also required to reduce the risk of microbial contamination. Trainings and information campaigns should be implemented to communicate safe composting techniques and food hygiene practices. Access to toilet and handwashing facilities with soap is required by law for all food handlers, but compliance in our sample is low. County governments should ensure all food business operators, from farm to retail, have access to information on hygiene and sanitation requirements, and that they comply with these regulations.

References

- ^a Macharia, I.N., Mitha, M. and Waibel, H., 2009. Potential environmental impacts of pesticides use in the vegetable sub-sector in Kenya. *African Journal of Horticultural Science*, 2.
- ^b Mutuku, M., Njogu, P. and Nyaga, G., 2014. Assessment of pesticide use and application practices in tomato based Agrosystems in Kaliluni sub location, Kathiani District, Kenya. *Journal of Agriculture, Science and Technology*, 16(2).
- ^c Abou-Arab, A.A.K., 1999. Behavior of pesticides in tomatoes during commercial and home preparation. *Food chemistry*, 65(4), pp.509-514.
- ^d National Academies of Sciences, Engineering, and Medicine (NASEM), 2017. "Chapter 2. Sources of Lead Contamination" in *Investigative Strategies for Lead-Source Attribution at Superfund Sites Associated with Mining Activities*. Washington, D.C.: National Academies Press.
- ^e Kibitok, S.K. and Nduko, J.M., 2016. Evaluation of microbial contamination of consumed fruits and vegetables salad (Kachumbari) around Egerton University, Kenya. *Journal of Food Safety and Hygiene*, 2(1/2), pp.26-29.
- ^f American Academy of Pediatrics, 2006. Lead Exposure in Children: Prevention, Detection and Management. *Pediatrics*, 116(4). Pp.1036-1046.
- ^g World Health Organization. 2019. *Exposure to Cadmium: A Major Public Health Concern*. WHO: Geneva.