

FOOD SAFETY IN KENYA:

Focus on fruits and vegetables

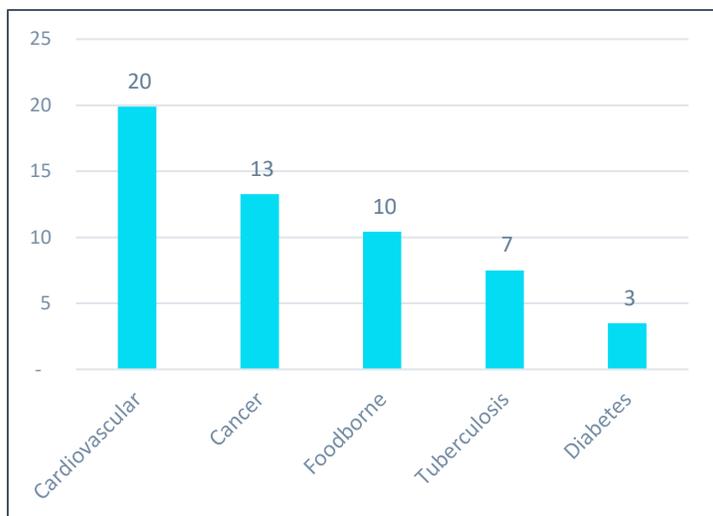
ERIC YEN, VIVIAN HOFFMANN, DELIA GRACE, JOSEPH KARUGIA, RIKKI AGUDAH*

WHY THIS NOTE?

Fruits and vegetables are an important source of micronutrients in the diet. Inadequate consumption of these foods contributes to an estimated 2.7 million deaths per year from chronic diseases and is the sixth main risk factor for mortality in the world.¹ Intake of fruits and vegetables in Kenya is below recommended levels.² Fruits and vegetables are not only nutritious for humans - bacteria and other foodborne pathogens also thrive on these foods, making them important sources of foodborne illness.

Foodborne diseases (FBDs) are responsible for a significant proportion of illness and death worldwide. In Kenya, contaminated food is a likely contributor to recent cholera outbreaks that killed 76 and sickened 3967 in the first eleven months of 2017.³ The Foodborne Disease Burden Epidemiology Reference Group (FERG), a panel of experts convened by the World Health Organization, has estimated that FBDs are responsible for a comparable number of illnesses and deaths in Africa as cancer or tuberculosis. (Figure 1).

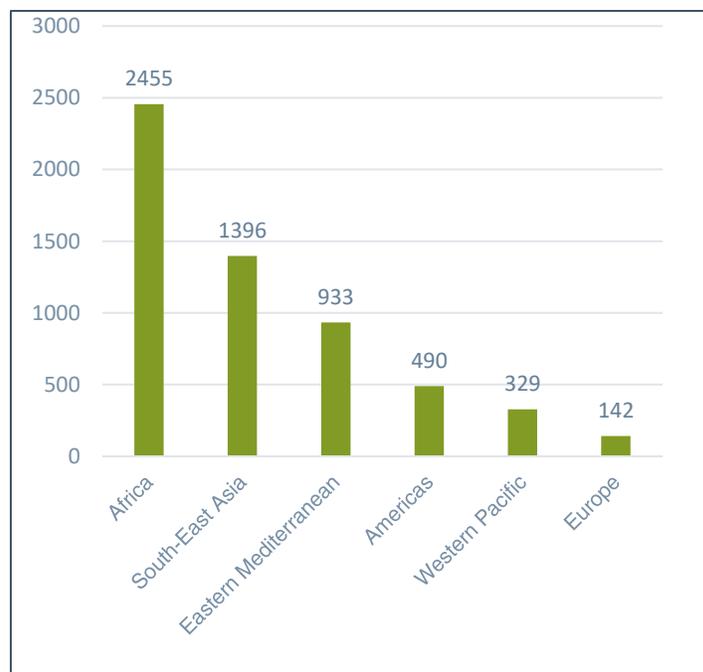
Figure 1. Estimated burden of foodborne disease and other selected illnesses in Africa, millions of disability adjusted life years (DALYs)^{4,5}



The estimated burden of foodborne disease is conservative and likely under-estimates the real burden of foodborne disease several fold. Treatment of illness is often not sought, and many of the treated cases are not reported to health authorities; when treated, there is usually no laboratory diagnosis or way of telling if an illness came from food or another source. Many foodborne hazards are also present in drinking water and can be transmitted from person to person. The figures above include only the share of illness caused specifically by contaminated food, based on the best and most recent estimates of experts.

The burden of FBD is not equally distributed across the globe. According to FERG estimates, the risk of foodborne illness is higher in Africa than any other region (Figure 2).

Figure 2. Estimated years of life lost to death or illness per 100,000 population, by region⁴



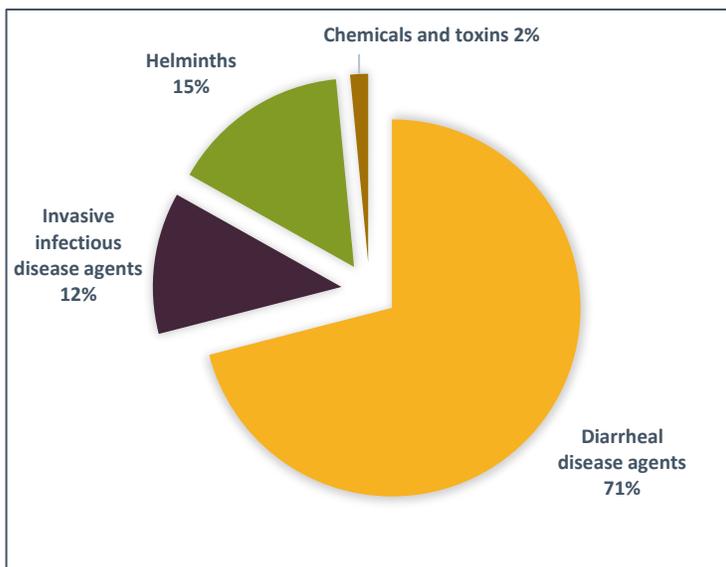
* Yen and Hoffmann are at the International Food Policy Research Institute (IFPRI); Grace and Karugia are at the International Livestock Research Institute (ILRI), and Rikki Agudah is with the Society of Crop Agribusiness Advisors of Kenya (SOCAA).

Children under five years of age bear a disproportionate share of the FBD health burden. Although this group constitutes only nine percent of the global population, it suffers from forty percent of the burden of FBD worldwide according to FERG estimates.^{4,6} In addition to immediate health out-comes, these diseases can have long term impacts on children’s physical and intellectual growth. Children with repeated cases of diarrhea during the first 24 months of life tend to be shorter at 24 months of age.⁷ Stunting and intestinal parasites (often transmitted by food) in early childhood have been linked to lower mental function later in life.⁸

HAZARDS: SUBSTANCES IN FOOD THAT CAN HARM HUMAN HEALTH

Foodborne hazards are biological, chemical, and physical contaminants with the potential to cause harm to human health. Biological hazards include viruses, bacteria, and parasites. Chemical hazards include pollutants in the water and soil used to grow crops, including heavy metals and other toxins. Some of the chemicals used in food production and storage, such as pesticides and disinfectants, may also constitute hazards. Physical objects that may cause harm include glass shards and nails.

Figure 3. Estimated burden of foodborne disease (DALYS per 100 000 population) in sub-Saharan Africa by hazard groups ⁴



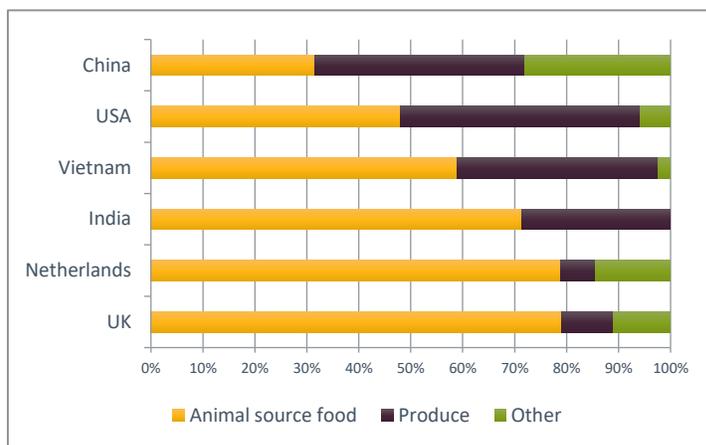
According to the FERG study, almost three quarters of foodborne DALYs in sub-Saharan Africa are caused by diarrheal disease agents while the remainder are attributed to invasive infectious disease agents, helminths, and chemicals and toxins (Figure 3).

FOODBORNE HAZARDS IN FRUITS AND VEGETABLES

The health benefits of a diet rich in fruits and vegetables far outweigh the risk of foodborne disease. However, careful preparation of these foods is important as perishable foods, including fruits and vegetables, probably account for a large share of foodborne disease. This has been clearly shown in numerous studies from developed countries. While fewer studies have been

conducted in developing countries, those that have attempted to link episodes of foodborne illness to specific foods have found that fresh produce was responsible for a significant share of illness (Figure 4 with some developed countries for comparison)^{9,10,11,12,13}. The share of cases attributed to produce was higher in the lowest-income countries of those studied (India and China), and in the high-income country with the weakest food safety regulatory system (USA).

Figure 4. Foods implicated in cases of FBD, according to FERG calculation. Figure replicated from Grace, 2015 ¹⁴



Types of Foodborne Hazards

Diarrheal disease agents are bacteria, viruses, and parasitic organisms that cause diarrhea, often by infecting the intestinal tract. Infection can occur through contaminated food and water or from person-to-person contact. This type of hazard is responsible for nearly 70% of FBD in Africa and is a leading cause of malnutrition and death in children under five years.

Invasive infectious disease agents are bacteria and viruses that attack the body through channels outside of the intestines. Common manifestations include bacteremia, hepatitis, and meningitis.

Helminths, commonly known as intestinal worms, are parasitic organisms such as roundworms, whipworms, and hookworms. Contamination of soil and water due to poor sanitation are major pathways of infection; food may also contain helminth eggs. Infection rates in some parts of rural Kenya are as high as 44% among children and 16% among adults.¹⁵

Chemicals and toxins include heavy metals (such as lead) and agrochemicals, (such as pesticides), as well as poisonous substances that are produced by living organisms.

Contamination of fruits and vegetables with food safety hazards can occur throughout the value chain, including during production, harvest, processing, transportation, retail, foodservice, and in the household.¹⁶ Contamination during production is often due to the use of wastewater from surrounding communities for irrigation. Techniques such as drip irrigation, furrow irrigation, and reduction of splashing can reduce levels of contamination.¹⁷ Poor hygiene and handling methods by traders and retailers also contribute to the spread of FBD.

Contributing practices include, use of unclean containers during transport and storage, failure to wash hands with soap prior to handling produce, displaying vegetables on the bare ground or in bowls of unchanged water, and not washing fruits/vegetables before display or washing with contaminated water.

While evidence specific to Kenya is scarce, studies conducted elsewhere indicate that food safety hazards affect fruits and vegetables in diverse settings. A study conducted in Thailand found that 46% of fresh vegetables were contaminated with Salmonella strains, some of which were potentially harmful to people.¹⁷ Another study found *Escherichia coli* (*E. coli*) strains in 18.1% of fresh-cut vegetables and fresh mung bean sprouts at a chain supermarket in Iran.¹⁸ *E. coli* was also found in 41.5% of organic vegetables and 40% of conventional vegetables at a market in Brazil.¹⁹ While not all *E. coli* strains cause illness, their presence is often used as an indicator of pathogenic contamination.

Chemical contaminants are also frequently found on fruits and vegetables, often due to weak chemical regulations and misuse by farmers unaware of their negative environmental or health effects.²⁰ Of 1,579 fresh produce samples analyzed by the Kenya Plant Health Inspectorate Service (KEPHIS), 1.7% were found to contain pesticides above the EU recommended maximum residue limit.²¹ However, as most of the samples analyzed by KEPHIS were destined for export markets, this rate of compliance is not representative of local markets. Analysis of locally marketed produce for pesticide residues elsewhere in Africa shows high rates of non-compliance. In Ghana, 32.8% of fruit sampled at a market was found to have insecticides above the accepted maximum residue limit.²² Some of these chemicals, if present at levels above those regarded as safe, may accumulate in the body and lead to harmful chronic effects.²³ The high cost of agrochemicals may create an incentive for farmers to use counterfeit products or chemicals unsuitable for a given crop.

ECONOMIC BENEFITS OF FOOD SAFETY

Horticultural crops are an important source of revenue for Kenyan farmers; the total production value in the sector was nearly 200 billion Kenyan shillings (KSh.) as of 2014.²⁴ The best prices for horticultural crops are observed in the export market and in supermarkets and specialty grocery stores in large urban centers such as Nairobi. Customers of these outlets tend to exhibit a high level of concern about food safety. In one study, consumers at a specialty grocery shop stated that they would pay up to 19.6 KSh/KG more (a premium of 68% over the base price) for kale produced and handled to ensure food safety.²⁵ Customers interviewed at roadside markets stated they would be willing to pay an average of 28% more for safer kale. Recent price data collected by the Society of Crop Agribusiness Advisors of Kenya (SOCAA) demonstrated the large premium available at specialty grocery retailers in Nairobi: the maximum price for tomatoes observed at one such shop on a particular day in February 2018 was 149 KSh/KG, while the average price at two nearby open-air markets was only 80 KSh/KG.

TRENDS AND OUTLOOK

Perishable products such as fruits, vegetables, and meat are an important part of diets in Eastern and Southern Africa, constituting 20% of food expenditures among poor households and up to 46% among the middle class.²⁶ Consumption of perishable foods is expected to increase both as a share of the food economy and in absolute quantities as a growing middle class demands a more diversified diet. As FBDs are primarily a problem of perishable foods, such diseases are likely to appear with greater frequency.

As food systems modernize and increase in scale, food is passed through more hands and bulked in larger quantities, increasing the severity of food safety problems. Investments in infrastructure to provide a steady electrical supply and clean water as well as development of a reliable cold chain, will all contribute to improving food safety as Kenya develops economically.²⁷

REDUCING THE RISKS OF FBD IN FRUITS AND VEGETABLES IN KENYA

Farmers, distributors and consumers of horticultural products can significantly reduce the risk of FBDs by adopting several low-cost practices such as use of safe water for irrigation, washing produce in clean water or disinfectant solution, peeling off its outer layer, and cooking food thoroughly.²⁸ For greatest effect, risk reduction strategies should be used at each stage, from farm to plate.

However, while all market actors have important roles to play in improving food safety, the role of the government is essential for providing a legal and regulatory framework, building capacity among market actors and laboratories to achieve and monitor compliance with standards, and providing information to consumers through certification and early warning systems.

Kenya's National Food Safety Policy of 2013 proposes a broad set of policy interventions to improve food safety in the country. These include the enactment of a National Food Safety Law and establishment of a national Food Safety Authority through which to coordinate government activities related to food safety; investment in training of stakeholders, especially small and medium enterprises (SMEs), on food safety and regulatory compliance; the provision of guidelines and technology to support traceability of food from farm to fork; improved analytical capacity through the accreditation of additional food safety laboratories and maintenance of an inventory of the same; and development of systems for food safety validation, inspection, certification and self-assessment as well as an early warning system to prevent outbreaks.

These important interventions have not, been implemented. While implementation at the national level remains important, counties could adopt many of these recommendations within their own jurisdictions. Priority action areas for food safety in horticultural crops are developing systems of traceability and regional certifications that include compliance with food safety standards.

Success in Kenya's export sector demonstrates the potential for public action to improve food safety. The Kenya Plant Health Inspectorate Service (KEPHIS) conducts audits of farm and packing houses involved in the production and processing of crops destined for export. KEPHIS reports that the introduction of risk based audits to assure food safety compliance for export companies resulted in a reduction of 44% in food safety notifications for products destined for the EU between 2015 and 2016.²⁹ Increased monitoring of food safety in crops consumed domestically could potentially improve practices in this segment of the market as well. Challenges related to the larger number of producers, and the lower level of market organization in the domestic sector, however, would need to be overcome in order to achieve comparable gains.

CONCLUSIONS AND RECOMMENDATIONS

- Consumption of fruits and vegetables is important for maintaining good health and preventing chronic disease; Kenyans consume too little of these foods relative to dietary recommendations.
- Contaminated fruits and vegetables are an important conduit of foodborne disease (FBD), which represents a significant share of the global burden of disease, particularly in Africa. Improving the safety of fruits and vegetables and increasing their consumption are both important for improving population health.
- Concern about food safety is high among consumers who shop at supermarkets and specialty grocery stores in Nairobi, and

prices for fruits and vegetables in these outlets are far above those observed in open-air markets. This suggests significant potential for farmers to benefit economically from the production of safe, high-quality produce if credible certification systems can be developed.

- The FBD burden, as well as premium market opportunities for horticultural producers, are set to continue to increase in Kenya as a burgeoning middle class demands a more diversified and nutritious diet.
- The risk of FBD can be reduced at every stage, from farm to fork. Increasing awareness among farmers, processors, retailers, and consumers is a critical step toward safer food in Kenya
- The Kenyan government has laid out a comprehensive set of actions to improve food safety in the 2013 National Food Safety Policy, but these have yet to be implemented. Many of these interventions could be adopted by county governments.
- Success by KEPHIS in the enforcement of regulations in crops destined for export demonstrate the potential for public action to improve food safety in Kenya, and should be emulated in the domestic market.

ACKNOWLEDGEMENTS

This project note was produced through the Voice for Change Partnership, a collaborative project of IFPRI and SNV Netherlands Development Organization, with generous financial support from the Dutch Ministry of Foreign Affairs.

¹ Ruel, M.T., Minot, N. and Smith, L., 2005. *Patterns and determinants of fruit and vegetable consumption in sub-Saharan Africa: a multicountry comparison*. Geneva: WHO.

² Van der Lans, C.J.M., Snoek, H.M., de Boer, F.A. and Elings, A., 2012. *Vegetable chains in Kenya: Production and consumption of vegetables in the Nairobi metropolis* (No. 1130). Wageningen UR Greenhouse Horticulture.

³ <http://www.who.int/csr/don/11-december-2017-cholera-kenya/en/>

⁴ World Health Organization, 2015. WHO estimates of the global burden of foodborne diseases: foodborne disease burden epidemiology reference group 2007-2015.

⁵ Global Burden of Disease Study, 2015.

Global Burden of Disease Study 2015 (GBD 2015) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2016.

⁶ United States Census Bureau, 2013. International programs: international data base.

⁷ Checkley, W., Buckley, G., Gilman, R.H., Assis, A.M., Guerrant, R.L., Morris, S.S., Mølbak, K., Valentiner-Branth, P., Lanata, C.F. and Black, R.E., 2008. Multi-country analysis of the effects of diarrhoea on childhood stunting. *International journal of epidemiology*, 37(4), pp.816-830.

⁸ Berkman, D.S., Lescano, A.G., Gilman, R.H., Lopez, S.L. and Black, M.M., 2002. Effects of stunting, diarrhoeal disease, and parasitic infection during infancy on cognition in late childhood: a follow-up study. *The Lancet*, 359(9306), pp.564-571.

⁹ Painter, J.A., 2013. Attribution of Foodborne Illnesses, Hospitalizations, and Deaths to Food Commodities by using Outbreak Data, United States, 1998–2008—Volume 19, Number 3—March 2013—Emerging Infectious Disease journal—CDC.

¹⁰ Sudershan, R.V., Naveen Kumar, R., Kashinath, L., Bhaskar, V. and Polasa, K., 2014. Foodborne infections and intoxications in Hyderabad India. *Epidemiology Research International*, 2014.

¹¹ Mangen, M.J.J., Bouwknegt, M., Friesema, I.H., Haagsma, J.A., Kortbeek, L.M., Tariq, L., Wilson, M., van Pelt, W. and Havelaar, A.H., 2015. Cost-of-illness and disease burden of food-related pathogens in the Netherlands, 2011. *International journal of food microbiology*, 196, pp.84-93.

¹² Tam, C.C., O'Brien, S.J., Tompkins, D.S., Bolton, F.J., Berry, L., Dodds, J., Choudhury, D., Halstead, F., Iturriza-Gómara, M., Mather, K. and Rait, G., 2012. Changes in causes of acute gastroenteritis in the United Kingdom over 15 years: microbiologic findings from 2 prospective, population-based studies of infectious intestinal disease. *Clinical Infectious Diseases*, p.cis028.

¹³ Sang, X.L., Liang, X.C., Chen, Y., Li, J.D., Li, J.G., Bai, L. and Sun, J.Y., 2014. Estimating the burden of acute gastrointestinal illness in the community in Gansu Province, northwest China, 2012–2013. *BMC public health*, 14(1), p.787.

¹⁴ Grace, D., 2015. Food safety in developing countries: An overview. Evidence on Demand, UK.

¹⁵ Andereck, J.W., Kipp, A.M., Ondiek, M. and Vermund, S.H., 2014. Helminth prevalence among adults in rural Kenya: a stool survey for soil-transmitted helminths and schistosomiasis in Nyanza province. *Transactions of The Royal Society of Tropical Medicine and Hygiene*, p.tru164.

¹⁶ Harris, L.J., Farber, J.N., Beuchat, L.R., Parish, M.E., Suslow, T.V., Garrett, E.H. and Busta, F.F., 2003. Outbreaks associated with fresh produce: incidence, growth, and survival of pathogens in fresh and fresh-cut produce. *Comprehensive reviews in food science and food safety*, 2(s1), pp.78-141.

¹⁷ Lertworapreecha, M., Sutthimusik, S. and Tontikapong, K., 2012. Antimicrobial resistance in salmonella enterica isolated from pork, chicken, and vegetables in southern Thailand. *Jundishapur Journal of Microbiology*, 6(1), pp.36-41.

¹⁸ Jeddi, M.Z., Yunesian, M., Gorji, M.E.H., Noori, N., Pourmand, M.R. and Khaniki, G.R.J., 2014. Microbial evaluation of fresh, minimally-processed vegetables and bagged sprouts from chain supermarkets. *Journal of health, population, and nutrition*, 32(3), p.391.

¹⁹ Maffei, D.F., de Arruda Silveira, N.F. and Catanozi, M.D.P.L.M., 2013. Microbiological quality of organic and conventional vegetables sold in Brazil. *Food Control*, 29(1), pp.226-230.

²⁰ Tschirley, D.L., Ayieko, M.W., Hichaambwa, M., Goeb, J. and Loescher, W., 2010. Modernizing Africa's fresh produce supply chains without rapid supermarket takeover: towards a definition of research and investment priorities (No. 93030).

Michigan State University, Department of Agricultural, Food, and Resource Economics.

²¹ KEPHIS, 2017. Annual Report and Financial Statements for the year ended 30th July 2017. <http://www.kephis.org/images/docs/2017annualreportforwebsite.pdf>

²² Bempah, C.K. and Donkor, A.K., 2011. Pesticide residues in fruits at the market level in Accra Metropolis, Ghana, a preliminary study. *Environmental monitoring and assessment*, 175(1-4), pp.551-561.

²³ Eddleston, M., Karalliedde, L., Buckley, N., Fernando, R., Hutchinson, G., Isbister, G., Konradson, F., Murray, D., Piola, J.C., Senanayake, N. and Sheriff, R., 2002. Pesticide poisoning in the developing world—a minimum pesticides list. *The Lancet*, 360(9340), pp.1163-1167.

²⁴ Horticulture Validated Report, 2014. Horticultural Crops Directorate (HCD), Agriculture, Fisheries and Food Authority (AFFA), Government of Kenya. 64 pp.

²⁵ Lagerkvist, C.J., Hess, S., Okello, J. and Karanja, N., 2013. Consumer willingness to pay for safer vegetables in urban markets of a developing country: The case of Kale in Nairobi, Kenya. *The Journal of Development Studies*, 49(3), pp.365-382.

²⁶ Tschirley, D., Reardon, T., Dolislager, M. and Snyder, J., 2015. The rise of a middle class in East and Southern Africa: Implications for food system transformation. *Journal of International Development*, 27(5), pp.628-646.

²⁷ Unnevehr, L. and Hoffmann, V., 2015. Food safety management and regulation: International experiences and lessons for China. *Journal of Integrative Agriculture*, 14(11), pp.2218-2230.

²⁸ Amoah, P., Keraita, B., Akple, M., Drechsel, P., Abaidoo, R.C. and Konradson, F., 2011. Low-cost options for reducing consumer health risks from farm to fork where crops are irrigated with polluted water in West Africa (Vol. 141). IWMI.

²⁹ KEPHIS Annual Report and Financial Statements for the year ended 30th June 2016