RAISE FS issue brief # 04

Food safety of spices in Ethiopia

WAGENINGEN UNIVERSITY & RESEARCH

This brief describes the specific food safety challenges encountered in the spice sector, specifically red pepper, ginger and turmeric, and highlights potential improvements.

Spices important for local consumption and export

Ethiopia has a long history of producing spices, and it is a source country for many spice exports. More than 50 spices are produced in the country of which ginger, turmeric, red pepper, cardamom, fenugreek, black cardamom (*korerima*), black pepper, cumin and caraway seed are the most common ones.

Around 90% of the spices produced are consumed locally. *Berbere*, a spice blend mainly consisting of red (chilli) pepper and often processed at home, is consumed daily. Although the potential for lowland spice farming is estimated to be 200,000 ha (GIT, 2016), production of the major spices has been relatively stagnant between 2016 and 2021 (Figure 1).

Red pepper production had been between 250,000 and 325,000 tons per year between 2016 and 2021, while the smallholder area holding for production had shifted from 180,000 to 168,000 ha for the same period, respectively. Similarly, ginger production increased only slightly from 1,030,000 tons on 3,538 ha in 2016 to 1,039,000 tons on 3633 ha. The export value of spices in 2021 is estimated to be US$7.83 million with India absorbing most of the produce (OEC).

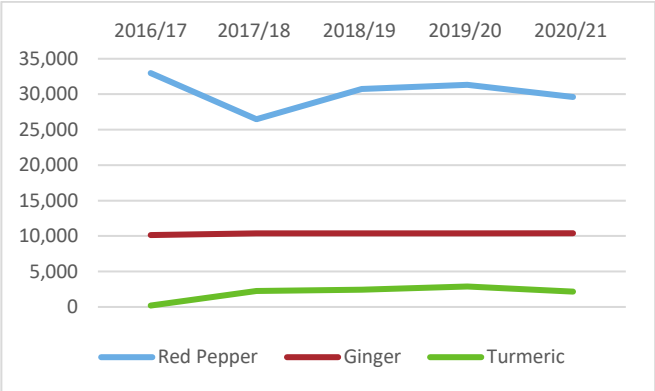

Figure 1 Annual production of selected spices (tons) (Source: FAOSTAT, ECTSA & CSA)

Key messages

- Spices are prone to **multiple food safety hazards** which potentially **affect the health** of consumers and **income from export**
- **The major food safety issue** found in spices from Ethiopia is **mycotoxins**, especially **aflatoxins and ochratoxins**
- **Levels exceeding the maximum levels** are present in samples of **red pepper** taken **from farm stores**, and **red pepper and turmeric** collected **from** the **markets**
- The only spice for which a standard is set is red pepper, ES 6838:2021
- **The monitoring and control system for the quality and safety of spices needs serious investment including laboratory testing facilities**
- **The private sector needs to increase its attention to good handling practices, traceability and** introduction of **systems like** Hazard Analysis and Critical Control Points (**HACCP**)

Food safety hazards

Spices are prone to multiple food safety hazards which potentially affect the health of consumers and income from export. Hazards are physical impurities, microbial contaminants and chemical residues. For fear that spices imported from Ethiopia might be contaminated, importers take various precautionary measures.

For instance, the European Union (EU 2019/1793) put additional control measures in place for spices imported from Ethiopia. Currently, there is 50% control of red pepper and various other spices for the presence of aflatoxins before entering the market.

The country has also received warnings from several importing countries indicating the food safety hazards identified on exported products.

Hazard 1: Physical impurities

Physical hazards could be **soil particles** or **plant parts** that should not be present in the spices produced.

The Ethiopian Standard ES 6838:2021 indicates that *berbere* should "be free from any impurities" and be "prepared from the pericarp and the seeds of the pepper fruit". The European Spice Association (ESA) sets a maximum level of 1% of material that could be present.

Physical hazards may occur due to drying the produce on the ground or other dirty substrate, or due to improper handling and cleaning of the spices and use of sub-standard packaging materials and storage facilities. These impurity levels could be brought down to the levels of standards by employing good handling and processing practices.

> ***Ginger***
> *Ginger is sun-dried on the ground for two to four weeks and becomes mixed with dirt and impurities. After being dried under such conditions, the dry ginger takes the smell of soil and other materials that affect ginger's normal pungency and taste. Hence, the flavour is less accepted in both local and central markets. The traditional processing is unhygienic and exposes ginger to contaminants and the development of mycotoxins. Working on the post-harvest handling of ginger can improve the current market challenge, especially in the international market (Kifile et al., 2023).*

Hazard 2: Microbial contaminants

Microbial contamination takes place mainly through **fungi** (e.g. *Aspergillus* spp.) and **bacteria**. Specifically, ES 6838:2021 indicates that the pathogenic bacteria *Staphylococcus aureus*, *Escherichia coli* and *Salmonella* spp. should be absent.

A study on a variety of spices purchased in the market (Bedada *et al*., 2018) found that some of the samples tested contained fungi, yeast, coliforms or *S. aureus*, but no *Salmonella* spp. The study further revealed that over 10% of the samples contained too high levels of microbial contamination. Conditions during harvest, drying, processing, and storage can highly affect the development of microbial contamination; and hygiene is an important factor to minimize contamination.

Hazard 3: Chemical residues and mycotoxins

Chemical hazards are pesticide residues, mycotoxins and heavy metals. The maximum residue levels (MRL) of pesticides should comply with the Codex Alimentarius or according to the MRLs set by the country of destination. Exceedances of the MRLs can occur when GAP is not followed. This can, for instance, happen when not adhering to the pre-harvest interval, or if non-registered pesticides are used. Alternatively, it can occur when there is cross-contamination during picking and harvesting, drying, threshing, transporting or in storage.

The occurrence of mycotoxins, and specifically aflatoxins is a serious threat to the production and trade of spices. The maximum levels (ML) are indicated in *Table* 1 below.

Table 1 – Maximum levels of aflatoxin (AF) B1 and total and Ochratoxin (OC) A of selected spices

	Ethiopia ES 6838:2021			**EU EC 1881/2006**		
	AF B1	sum AF	OC A	AF B1	sum AF	OC A
Red pepper	5	10	15	5	10	15
Ginger	--*	--	--	5	10	15
Turmeric	--	--	--	5	10	15
Mixtures	--	--	--	5	10	15

* No limit set yet

In a study conducted by Aberedew and Ayelign (2023), samples of powdered red pepper collected from markets in Addis Ababa contained levels of both aflatoxin B1 and total aflatoxin above the ML. Samples of red pepper collected in 2023 from farm-stored produce (Taddesse et al, forthcoming) also showed 100% and 98% positive for total aflatoxin and ochratoxin A 92% and 88% above the ML respectively.

The main causes for high levels of mycotoxins are poor handling practices, especially failure to dry produce adequately and storing them under moist conditions. For red pepper, the practice of wetting the produce before selling it to enhance colour and prevent breakage to obtain a better price contributes to the development of mycotoxin producing fungi.

A study done on post-harvest spoilage of turmeric taken from zones in southwestern Ethiopia in 2020 and 2021 indicated the presence of *Aspergillus* spp., *Penicillium* spp., *Fusarium* spp., and *Rhizopus* spp. was found in samples of dried and stored turmeric (Jibat *et al*., 2023). It also highlighted that the percentage of incidence ranged from 15.1% for *Fusarium* spp. to 45.2% for *Aspergillus* spp. In 2018, the Ethiopia-Netherlands Trade for Agricultural Growth project collected over 40 samples of turmeric from various locations in the southern region of Ethiopia. The samples tested for the presence of aflatoxin showed that 13 of the 40 samples had aflatoxin levels that exceeded the EU standards for maximum levels (unpublished data).

Heavy metals that should be managed in spices are arsenic, mercury, lead and cadmium with specific levels for berbere of 0.5, 0.1, 1 and 0.5 ppm resp. (ES 6838:2021).

Hazard 4: Adulteration

The Ethiopian Food and Drug Administration defines adulteration as "*the addition of any foreign substance or ingredient to food or replacing the content of the product with another substance to increase the mass or weight of a product and enhance its value"* (see Haji *et al*., 2023). Adulteration can take place by mixing varieties or below standard or spoiled pods, salt, clay or synthetic additives such as Sudan red dye, or through the reintroduction of moisture (Fanta & Tesafa, 2018; Haji *et al*., 2023).

Unscrupulous actors adulterate spices and their products for the pursuit of higher profits using the gap in food safety standards, regulatory measures and enforcement.

Challenges

Organizations and actors of the Ethiopian spice sector regulation were interviewed on their view of food safety challenges (see Ayelign *et al*., 2023). Challenges that were identified concerning ensuring food safety in both the domestic and export markets were:

- Lack of knowledge about food safety among value chain actors.
- Absence of guidelines on good agricultural practices (GAP) and good post-harvest handling practices (GHP);
- A dearth of appropriate machinery to process the products;
- Failure to introduce good practices for handling, storing, and processing spices;
- Crop seasonality and absence of quality raw materials outside of the harvest time;
- The limited capacity of laboratories in testing mycotoxins and the high cost of analysis fees;
- The lengthy processing time required to do food safety assessments causes delays and impacts delivery and price;
- Poor enforcement of food safety standards and lack of quality control mechanisms;
- The impracticality of tracing the source of contamination of a food safety hazard;
- Resource limitations preventing research on quality and food safety issues in the spice sector; and
- Limited provision of training of stakeholders and actors involved in the spice value chains.

Recommendations

Based on the challenges identified, it is recommended to:

- ✓ Test spices for hazardous contaminants and develop food safety standards for spices - currently there is only a standard for berbere;
- ✓ Improve the laboratory testing facilities, human capacity and procedures to serve the industry;
- ✓ Create awareness and provide advice on GAP and GHP for value chain actors;
- ✓ Establish a Hazard Analysis and Critical Control Point (HACCP) system to improve post-harvest handling practices, storage, and transportation;
- ✓ Improve inspection and enforcement mechanisms for spice processors;
- ✓ Establish a traceability system to track and trace sources of food safety problems that occur
- ✓ Solicit budget for investigating spice sector related contaminants;
- ✓ Develop sustainable input delivery systems and water management practices to reduce seasonal variation;
- ✓ Enhance private sector engagement to invest in suitable technologies that reduce contamination of spice during production, processing, transporting and storage; and
- ✓ Design of a communication platform about spice related hazards and control mechanisms for the wider community.

References & resources

Aberedew, K., & Ayelign, A. (2023). Aflatoxin contamination in red pepper from producers in Addis Ababa. *Food Additives & Contaminants: Part B*, *16*(1), 1-7 https://doi.org/10.1080/19393210.2022.2102678

Ayelign, A., Alemayehu, G., Sopov, M., Getaw, H., Koomen, I. (2023). The Ethiopian National Food Control System – an assessment. SWRE-RAISE-FS-23-023 https://doi.org/10.18174/648410

Bedada, T. L., Derra, F. A., Gebre, S. G., Sima, W. G., Edicho, R. M., Maheder, R. F., ... & Asefa, Y. B. (2018). Microbial evaluation of spices in Ethiopia. *The Open Microbiology Journal*, *12* (1) DOI: http://dx.doi.org/10.2174/1874285801812010422

EC 1881/2006 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02006R1881-20140701 – accessed 20/11/2023

ES 6838:2021 Pepper powder (*Capsicum pepper*) — Specification – 1st edition

Fanta, A., & Tesafa, F. (2018). Aflatoxin related challenges and mitigation strategies of Ethiopia in spices, herbs and pulses' domestic and international markets. BENEFIT-ENTAG report.

Haji, A., Desalegn, K., & Hassen, H. (2023). Selected food items adulteration, their impacts on public health, and detection methods: A review. *Food Science & Nutrition* https://doi.org/10.1002/fsn3.3732

Jibat, M., & Alo, S. (2023). Postharvest spoilage pathogen associated with turmeric (Curcuma longa L.) product in Southwestern Ethiopia. *International Journal of Agricultural Research, Innovation and Technology (IJARIT)*, *13*(1), 1-5. https://doi.org/10.3329/ijarit.v13i1.67943

Kifile A., Bekele A., Tefera T., Alemu D., Koomen I., Diro M., and Nigussie D. (2023). Importance of Ginger in Ethiopia: recent trends and challenges. Stichting Wageningen Research Ethiopia. Addis Ababa. SWRE-RAISE-FS-23-009 http://dx.doi.org/10.18174/635326

OEC https://oec.world/en/profile/bilateral-product/spices/reporter/eth - accessed 20/11/2023

Citation: Getaw H., Alemayehu G., Koomen I., and Sopov M. 2024. Food Safety of Spices in Ethiopia. Stichting Wageningen Research Ethiopia, Addis Ababa. SWRE-RAISE-FS-23-024. https://doi.org/10.18174/656483

For more information on RAISE-FS please **contact** either:

Dawit Alemu

Stichting Wageningen Research - Ethiopia
dawit.alemu.swr@gmail.com

Dr. Irene Koomen

Wageningen Centre for Development Innovation
irene.koomen@wur.nl

www.raise-fs.org