

Assessment of pesticide residue levels in vegetables produced in central and eastern Ethiopia: a one health perspective

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Introduction

- Pesticides improve agricultural production by protecting crops from pests ¹, but their inappropriate use creates health risks for consumers, other organisms and the environment ^{2,3}.
- The use of chemical pesticides in agriculture is rapidly increasing in Ethiopia ², however, there has been inadequate awareness and enforcement of good practices when using pesticides⁴: incorrect pesticide handling, usage, and management is widespread in Ethiopia ^{2,4}.
- Monitoring of pesticide residue concentrations in vegetables should be performed routinely to monitor foods for MRL compliance ⁹⁻¹¹. However, studies assessing pesticide residue levels in vegetables in Ethiopia are scarce. This study aimed to **assess levels of pesticide residues in vegetables from farms and retail markets in central and eastern Ethiopia.**

One Health relevance

- Pesticides protect crops from pests and increase agricultural production. But pesticides have various adverse effects to non-target organisms in the environment, including humans, animals, water bodies and soil.
- This implies efforts that aim to minimize effects of pesticides should involve multisectoral sectors considering the interconnection between people, animals, plants, and their shared environment: **A One Health approach**. This study provides information on levels of pesticide residues in vegetables which indicates potential health risks to consumers.

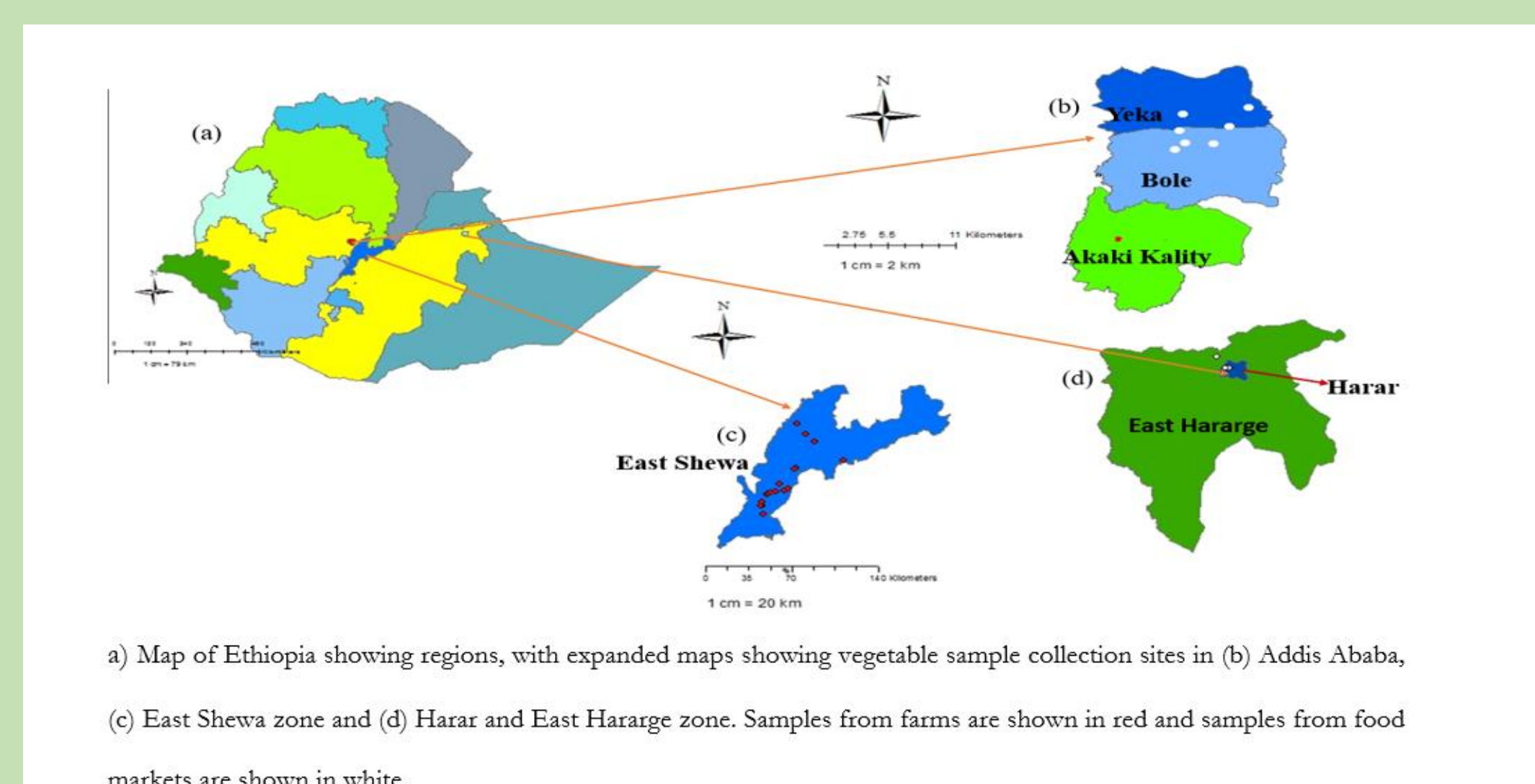
Conclusions

- Results showed that locally produced vegetables had pesticide residues above EU MRL but below that of Codex.
- Study vegetables were most predominantly contaminated with organophosphate pesticides.
- Our finding also revealed multiple occurrences of pesticide residues in locally produced vegetables.
- This is still a concern as the detected pesticides are associated with chronic health problems and environmental effects.
- We recommend improving awareness of the dangers of pesticides amongst producers and appropriate practices, strengthening pesticide regulation and monitoring.
- This is relevant across Sub-Saharan Africa.

Materials and methods

Study areas, sample collection and preparation

- Tomatoes (n=106), cabbages (n=91) and Swiss chard (n=35) were sampled from vegetable markets (both wholesalers and retailers) in the city of Harar and Addis Ababa, from farmers' fields in East Shewa zone in Oromia and from vegetable plots within Addis Ababa (see below figure).
- Quick, Easy, Cheap, Effective, Rugged and Safe (QuEChERS) method was used to extract and clean the vegetable samples followed by gas chromatography-mass spectrometry analysis ¹³.



organochlorine (n=14) pesticides including insecticides, acaricides, fungicides, fumigants, synergists and others.

Statistical data analysis

- Lacking a national MRL, pesticide residues ($\mu\text{g}/\text{kg}$) were compared with MRLs of the Codex Alimentarius Commission and European Commission regulations ¹⁴.
- While pesticide residues above MRL of EU or Codex were quantifiable, those below were considered just detectable, although at these very low levels test accuracy was uncertain.

Results

- About 47% (50/106, 95% CI: 37%-57%), 45% (41/91, 95% CI: 34%-55%) and 60% (21/35, 95% CI: 42%-76%) of cabbages, tomatoes and swiss chard samples had at least one type of detectable pesticide residues, respectively.
- About 15% (34/232, 95% CI: 10%-20%), 10% (11/106, 95% CI: 5%-18%), 8% (7/91, 95% CI: 3%-15%) and 46% (16/35, 95% CI: 29%-63%) of total vegetable, cabbages, tomatoes and Swiss chard samples had pesticide residue levels above EU MRL, respectively.
- **But none of our study vegetable samples had pesticide residue levels exceeding Codex MRL.**
- Two or more pesticides were detected in 22% (52/232, 95% CI: 14%-36%), 20% (21/106, 95% CI: 13%-29%), 13% (12/91, 95% CI: 7%-22%) and 54% (19/35, 95% CI: 37%-71%) of total vegetable, cabbages, tomatoes and Swiss chard samples, respectively.
- While bendiocarb, diazinon, endrin, piperonyl butoxide, profenofos and propargite were detected, **only diazinon, propargite and profenofos had residual values above EU MRLs.**

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