

Report

Pesticide residues on Tomatoes from Addis Ababa vendors.

By:

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Introduction

Indiscriminate and illegitimate use of pesticides, their mishandling and negligence to follow proper application procedures and waiting periods are common practice of farmers and farm workers in Ethiopia (Negatu et al., 2016). Routine monitoring systems for pesticide residues on marketed agricultural products are non-existing. The lack of (reliable) data and the incapacity of governmental organs on improving the safety of food quality could further feed the mistrust of the consumers on the quality of agricultural products. Two recent studies already showed high levels of aflatoxin or antibiotics in food products (Gizachew et al., 2015; Groot et al., 2016). What is remaining are many separate observations from laboratories and food processors indicating wide -spread biological and chemical contamination of food products. These observations, however, lack thorough scientific investigation and transparency.

One of the food concerns is the high level of pesticide contamination of tomatoes (*Lycopersicon esculentum*). It is possible that tomato plants are treated with excessive amounts of pesticides, under which illegitimate components such as organochlorides. In this trial, tomatoes will be randomly collected on food markets and investigated for the presence of critical amounts of pesticide residues.

Objective

General Objective

Detection of the presence and amount of organochlorine pesticides (OCP), organonitrogen pesticides (ONP), organophosphate pesticides (OPP) and others (Table 1) on tomatoes (*L. esculentum*) collected on local markets in Addis Ababa, Ethiopia.

Specific Objectives

- To determine the type of pesticides on tomato skin and tomato pulp.
- To determine the concentration of the pesticides in $\mu\text{g kg}^{-1}$ food product
- Search for national regulations that stipulate the levels of residues in foods
 - if available, compare results with the regulations
- Depending on the results, discuss the possible effects on public health.
- Depending on the results, propose actions to be taken.

Materials, Methods, and Procedures

Ethical considerations

None applicable

Other considerations

In a previous scientific study on aflatoxin concentration in dairy products in Addis Ababa, the involved scientist were subjected to threats and oppression from governmental bodies. The overall impression is that publication of facts which are opposed to government strategies, will result in strong oppression and disciplinary actions. **It is therefor of major importance that this proposal is handled in upmost discretion.**

Sampling procedure and Sample size

Tomatoes were bought from two different vendors. Each vendor was asked for the origin of the tomatoes. Tomatoes were collected in separate plastic bags with an identification number. One pesticide free tomato should be used as a blanc control.

Measurement and Data Collection

Analysis will be performed by:

Eurofins Laboratorium Zeeuws-Vlaanderen B.V.

- Zandbergsestraat 1
- 4569 TC Graauw
- Tel: +31 114 635 400 (algemeen)
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Methods of analysis

Analysis methods are GCMSMS and LCMSMS (combi analysis, via triple quad) which will screen the samples on about 600 pesticiden screened. Each sample must contain minimal 10 tomatoes and 1 kg of volume.

Results

On 23th of June 2016, tomatoes (*Solanum lycopersicum*) were purchased from two different vendors in Old Airport area, Addis Ababa, Ethiopia (picture 1). The volume of both samples were sufficiently large according to EU standards (table 1). Pesticide free tomatoes for blanc control could not be obtained.

Picture 1. Purchased tomatoes.



Table 1. Collected samples.

Vendor	Sample nr.	origin	Amount
1	16BC029P	Debre Zeid	1,1kg
2	16BC030P	Meki	1,3 kg

The tomatoes received at the laboratories on the 27th of June and further processed the same day. The analyzed pesticides are documented on DRF-133 version 12 valid from 06-05-2016. Table 2 shows the results from the analyses. The results are performed according to the 'bij de Raad voor Accreditatie' accredited processes (registration number L201).

Table 2. Mg pesticide residues per kg sample 16NCo29P and sample 16NCo30P, compared with the European Union Maximum Residue Levels (MRL EU) and Acute Reference Dose in The Netherlands (ARfD NL).

Pesticide (GC-MSMS) ¹	Result (mg/kg)		MRL EU (mg/kg)	MRL EU (%)	ARfD NL (%)
	16NCo29P	16NCo30P			
Lambda-Cyhalothrin	0,019 ^a	0,011 ^a	0,1	19,0	20,39
Propiconazole	0,013 ^a	0,015 ^b	0,3	0,4	0,24
Bupirimate	nd	0,014 ^a	2,0	0,7	0,00
Tebuconazole	0,025 ^a	nd	0,8	3,1	7,02
Chlorantraniliprole	0,011 ^b	0,015 ^b	0,6	1,8	0,00
Methoxyfenozide	0,050 ^b	0,069 ^b	2,0	2,5	1,34
Tebuconazole	0,010 ^b	nd	0,9	1,1	1,79

^a Gas Chromatography & Mass Spectrometry; ^b Liquid Chromatography & Mass Spectrometry; nd = not detected

The MRL EU and ARfD NL summaries for sample 16NCo29P are 28,0 % and 30,8%, respectively. For sample 16NCo30P the summaries are 18,2% and 13,9%, respectively. The evaluation of the two samples according to vegetable- and fruit portal model and the UNIVeG model in The Netherlands and Germany are showed in table 4. The described pesticides have been approved for use on tomatoes according to the EU pesticide database (table 3).

Table 3. Toxicological information with EU Reference values.

	Status	Classification	ADI	ARfD	AOEL
Lambda-Cyhalothrin	Approved	Insecticide	0,0025	0,005	0,00063
Propiconazole	Approved	Fungicide	0,04	0,3	0,1
Bupirimate	Approved	Fungicide	0,05	na	0,05
Tebuconazole	Approved	Acaricide	0,01	0,02	0,01
Chlorantraniliprole	Approved	Insecticide	1,56	na	0,36
Methoxyfenozide	Approved	Insecticide	0,1	0,2	0,1
Tebuconazole	Approved	Fungicide	0,03	0,03	0,03

na = not applicable; ADI = Acceptable daily intake; ARfD = Acute reference dose; AOEL = Acceptable operator exposure level. The ADI and AOEL are expressed in mg/kg bw per day. The ARfD is expressed in mg/kg bw.

Table 3. Evaluation of samples (16NCo)29P and (16NCo)30P according to two different models in The Netherlands and Germany.

Supermarkets	Approved		MRL		Sum MRL		ARfD		Sum ARfD		Nr. pesticides		Pesticide blacklist	
	29P	30P	29P	30P	29P	30P	29P	30P	29P	30P	29P	30P	29P	30P
Evaluation NL according to vegetable and fruit portal model														
Aldi NL	NO	NO	ok	ok	ok	ok	na	na	ok	ok	> 5	ok	ok	not ok
Lidl NL	YES	YES	ok	ok	na	na	ok	ok	ok	ok	na	na	na	na
Plus NL	YES	YES	ok	ok	na	na	na	na	ok	ok	na	na	na	na
C1000/JUMBO	YES	YES	ok	ok	na	na	ok	ok	na	na	ok	ok	ok	ok
Albert Heijn	YES	YES	ok	ok	na	na	ok	ok	na	na	na	na	na	na
Superunie	YES	YES	ok	ok	na	na	na	na	na	na	na	na	na	na
Evaluation DE according to vegetable and fruit portal model														
Dohle	NO	YES	na	na	ok	ok	na	na	ok	ok	> 5	ok	na	na
Tegut	NO	NO	ok	ok	na	na	ok	ok	na	na	> 4	> 4	na	na
Tengelmann	YES	YES	ok	ok	ok	ok	ok	ok	ok	ok	na	na	na	na
Plus DE	YES	YES	ok	ok	na	na	na	na	ok	ok	ok	ok	na	na
Evaluation DE according to UNIVEG model														
Aldi DE	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	> 5	ok	not ok	not ok
Lidl DE	YES	YES	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
REWE	NO	YES	ok	ok	ok	ok	ok	ok	ok	ok	not ok	ok	ok	ok
Kaufland	YES	YES	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
Metro	YES	YES	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
Globus	NO	YES	ok	ok	ok	ok	ok	ok	ok	ok	> 5	ok	ok	ok
Norma	NO	YES	ok	ok	ok	ok	ok	ok	ok	ok	> 5	ok	ok	ok
Edeka	NO	YES	ok	ok	ok	ok	ok	ok	ok	ok	> 5	ok	ok	ok
Global 2000	YES	YES	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok

na = not applicable

Discussion

The pesticide residues found on 'Ethiopian' tomatoes are acceptable by the majority of supermarket branches in The Netherlands and Germany. The major threshold for admittance in the studies tomatoes is the number of pesticide residues found, still, the concentrations of each detected pesticide are all below the maximum reference levels. All detected pesticides are approved for use in the EU. Only Aldi supermarkets have listed Lambda-Cyhalothrin, belonging to the class of pyrethroids, on the pesticide blacklist. The pesticide is a moderately toxic insecticide and used in most agricultural sectors (Annex I).

Specimens in this study were supposed to be transferred to Bless Laboratories in Lege Tafo. Although the lab is well equipped, there are only reference values available for a limited number of pesticides. Furthermore, the laboratory could not be reached by telephone or email. It was therefor decided to transport the samples to the laboratory in the Netherlands. Only two samples were collected due to limited available financing (private funds). According to the Netherlands Food and Consumer Product Safety Authority and the customs regulations, a maximum of 5 kg of fresh vegetables and fruits is allowed to be imported for private use. At the Ethiopian customs, regulations are interpreted at their own discretion and carrying several separate bags of tomatoes in private luggage might've attracted their attention. In case is is decided to continue analyzing fruit and vegetables for pesticide residues, small batches can be carried in private luggage and frozen at the laboratory until further processing of a large batch. Otherwise, permission is to be requested from the Dutch authorities and, in particular, the Food, Medicine and Health Care Administration and Control Authority of Ethiopia (FMHACA) and customs in Ethiopia. At FMHACA, however, no legislations are available on pesticide directives and standards.

Author's contribution

RJtH: Writing proposal. Data interpretation. Reporting.

GJAB: Organisation. Financing

Literature

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ANNEX I. Pesticide standards

Common name	Chemical Class	Risk	Type
Abamectin	Bio-origin	ISO 1750 approved	Insecticide, acaricide, nematocide
Aldrin	Organochloride	Banned	Insecticide
Aziphos-methyl	Organophosphate	Banned	
Bupirimate	Pyrimidines	low toxic	Fungicide
Boscalid	Carboxamide	unlikely to present acute hazard	Fungicide
Carbendazim	Benzimidazole	unlikely to present acute hazard	Fungicide
Carbosulfan	Carbamate	Banned	Insecticide
Chlordane	Organochloride	Banned	Insecticide
Chlorantraniliprole	Anthranilic diamide	low toxic	Insecticide
Chlorothalonil	Chloronitrile, organic	unlikely to present acute hazard	Fungicide, acaricide
Chlorpyrifos	Organophosphate	moderately toxic	Insecticide, acaricide, miticide
Co-ral	Organophosphate	highly toxic	Insecticide
Cymoxanil	Cyan acetamide	moderately toxic	Fungicide
DDT	Organochloride	Banned	Insecticide
Deltamethrin	Pyrethroid	moderately toxic	Insecticide
Diazinon	Organophosphate	moderately toxic	Insecticide
Dicopper chloride trihydroxide	inorganic	moderately toxic	Fungicide
Dieldrin	Organochloride	Banned	Insecticide
Dimethoate	Organophosphate	moderately toxic	Insecticide
Disulfoton	Organophosphate	Banned	Insecticide
Endosulfan	Organochloride	moderately toxic	Insecticide
Ethion	Organophosphate	highly toxic	Insecticide
Fenitrothion	Organophosphate	moderately toxic	Insecticide, miticide
Fenthion	Organophosphate	low toxic, restricted use	insecticide, avicide, acaricide
Fosetyl Aluminium	Organophosphate	unlikely to present acute hazard	Fungicide
Glyphosate	Posponoglycine	slightly toxic	Herbicide
HCB	Organochloride	Banned	Fungicide
Heptachlor	Organochloride	low toxic, restricted use	Insecticide
Heptachlor epoxide	Organochloride	low toxic, restricted use	Insecticide
Imidacloprid	Neonicotinoid	moderately toxic	Insecticide
Iprodione	Dicarboximide	slightly toxic	Fungicide
Lambda-cyhalthrin	Pyrethroid	moderately toxic	Insecticide
Lindane	Organochloride	Banned in agriculture	Insecticide, acaricide, miticide
Malathion	Organophosphate	low toxic	Insecticide

Common name	Chemical Class	Risk	Type
Mancozeb	Dithiocarbamate	unlikely to present acute hazard	Fungicide
Metalaxyl	Phenylamide	moderately toxic	Fungicide
Methoxyfenozide	Diacylhydrazine	Not Acutely Toxic	Insecticide
Parathion	Organophosphate	Banned	Insecticide, acaricide
Parathion methyl	Organophosphate	moderately toxic	Insecticide
Phorate	Organophosphate	Highly toxic	Insecticide, acaricide
Phosalone	Organophosphate	Banned	Insecticide, acaricide
Pirimiphos-methyl	Organophosphate	moderately toxic	Insecticide
Profenofos	Organophosphate	moderately toxic	Insecticide
Propamocarb hydrochloride	Carbamate	unlikely to present acute hazard	Fungicide
Propiconazole	Triazole	High (Cramer class III)	Fungicide
Spinosad	Bio-origin	slightly toxic	Insecticide
Sulfur	Inorganic	slightly toxic	Fungicide
Tebuconazole	Azole	moderately toxic	Fungicide
Tebufenpyrad	Pyrazole	unlikely to present acute hazard	Insecticide, acaricide
Thiamethoxam	Neonicotinoid	moderately toxic	Insecticide
Triadimefon	Triazole	moderately toxic	Fungicide

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Annex II Budget

Version 1.0

Page 10

Salaries & Wages		Euro
Personnel	(8hrs x 2 days x €40,-) = €640,00	
Equipment & material		
Office equipment		NA
Collection material		€7
Travel		
Sample collection		€0,00
Sample transport		€11,25
Services		
Lab analyses	2 x€ 200- (ex BTW) = € 400,-	
TOTAL		€1 058,25