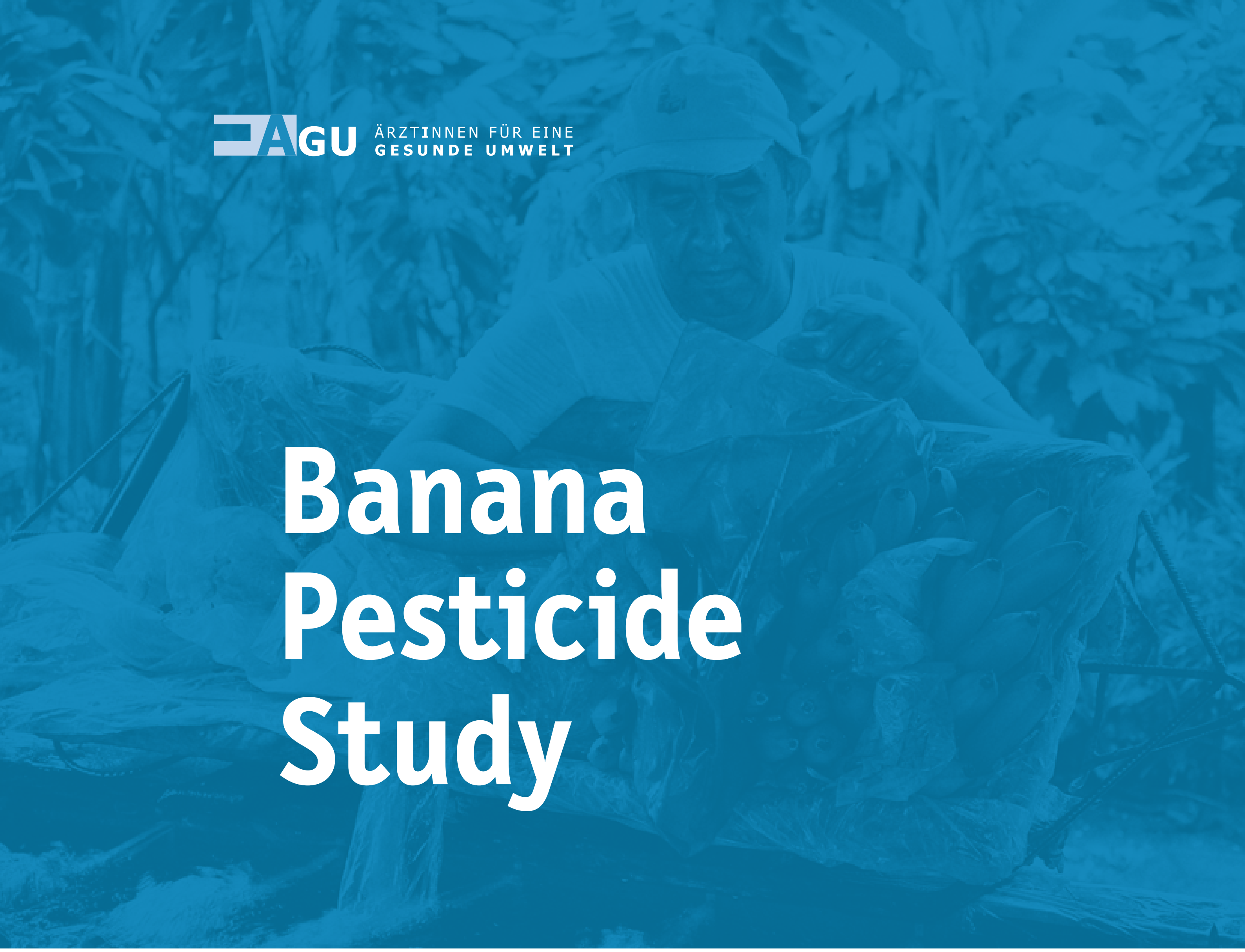

ÄRZTINNEN FÜR EINE GESUNDE UMWELT

Banana Pesticide Study

Epidemiological study on small-scale farmers and farm workers in conventional and organic agriculture (Bananas) in Ecuador

Report on the Questionnaire Survey

March 31, 2016

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This publication was produced with the financial assistance of the European Union. The contents of this publication are the sole responsibility of the authors and can under no circumstances be regarded as reflecting the position of the European Union.

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WIR DENKEN UMWELT.

Abstract

Banana Pesticide Study

Introduction Pesticide use in the cultivation of "cash crops" such as banana is increasing worldwide. Agrochemical use and occupational as well as environmental exposures in export banana production have been documented in some parts of Ecuador, the world's largest exporter of bananas.

The aim of our cross-sectional epidemiological study was to determine the living and working conditions, wellbeing and health of farm workers and small-scale farmers in fair/organic farming and of workers in conventional farming using biocides.

Material and methods Seventy-one farm workers at five locations in the provinces of Los Rios and El Oro in Ecuador volunteered to participate voluntarily.

A structured questionnaire on health (e.g. self-reported symptoms) and exposure indicators (e.g. pesticide application practices) was used for the medical survey. The questionnaire was administered by interviewers from the study areas previously trained by the research team. Furthermore, swab samples of buccal cells were taken with a wooden spatula for further analyses of genotoxic effects.

Results and discussion In total, 34 pesticide-exposed and 37 non-pesticide exposed male farm workers participated. The evaluation of the survey revealed that health of the pesticide users is affected by the use of biocides in conventional banana production. Pesticide workers showed significantly more often symptoms such as dizziness, vomiting, diarrhea, burning eyes, skin irritation, fatigue, and insomnia. We found that the exposed group had a 6–8-fold increased risk for reporting gastrointestinal symptoms (in the last 6 month) than the control group who did not use pesticides. The majority of participants had no knowledge which pesticides they apply (55 %). However, those who knew were using potentially harmful substances. Some of these biocides are classified as probably carcinogenic (e.g. glyphosate). The situation is aggravated by the fact that the farmers used only minimal protective clothing. During pesticides application only one-fifth of the farmers working with pesticides regularly use masks and gloves for personal protection – mostly because they are not provided by the employers.

Conclusion Under prevailing conditions of conventional farming with extensive pesticide use, health risks are inevitable. Results of the survey demonstrate the need for occupational safety measures including training and protective clothes as well as encouraging minimal application of pesticides and/or organic farming.

1. Background and objectives

Pesticides are used extensively in conventional agriculture. A particular case in point are tropical monoculture plantations (bananas, coffee, cocoa) producing for export markets in industrialized countries.

The debate on pesticides is dominated by consumer concerns about pesticide residues in food. Less attention is given to the impacts on farmers and their families who are generally much more exposed to pesticides than the population at large. Small-scale farmers, farm workers resp. pesticide appliers in the countries of the Global South are population groups with a particularly strong exposure (Laborde et al. 2015, Muñoz-Quezada et al. 2012, Handal et al. 2008, 2007, Grandjean et al. 2006).

The working conditions and the health of small-scale farmers and farm workers in the countries of the Global South have become more of an issue during the last years. Farm workers and people living close to plantations often complain about health issues caused by pesticide exposure. This exposure may result from direct handling/application of pesticides or from other routes (water, food, clothing) (Damalas and Eleftherohorinos 2011, Perry and Layde 1998, Oudbier et al. 1974).

The health risks (tumour diseases, neurological diseases, reproductive disorders) are related, i.a., to the exposure to harmful pesticides during application and to bad working conditions leading to substantial exposure. Several of these pesticides are already banned in Europe. Also at risk are vulnerable population groups such as children, the elderly and persons in bad health (UNEP 2004).

Farm workers in the countries of the Global South have little knowledge about the health risks posed by pesticides (e.g. no or insufficient training provided by employers, lack of rights, little or no reading and writing ability, chemicals are labelled in a foreign language).

There is little awareness of the dangers involved among the employers as well. In addition, several life circumstances (poverty, high unemployment rates, poor education) foster a careless attitude among farm workers when dealing with pesticides (lack of or inadequate prevention and protection measures) (e.g. Okonya & Kroschel 2015).

In Europe, minimum standards for personal protective equipment in pest management are stipulated by law, yet in other regions of the world such regulations are only rudimentary or don't exist at all.

Because of the high use of pesticides in conventional cultivation, banana production is a particularly suitable study object. Conventional and organic cultivation clearly differ in terms of pesticide exposure. A further important aspect is the fact that these tropical fruits are mainly produced for export markets (e.g. in the EU).

Ecuador is the biggest exporter of bananas to the European Union. As part of an international campaign focussing on working conditions in tropical fruit production ("Make Fruit Fair!" www.makefruitfair.org), an epidemiological study (cross-sectional study) in Ecuador has been planned and carried out in cooperation with the organization Südwind (Verein für Entwicklungspolitik und globale Gerechtigkeit, a non-governmental organization in the field of development policy and global justice Vienna, Austria, www.suedwind.at).

The aim of the project is to examine acute and chronic health effects in farm workers involved in conventional banana cultivation. The control group consisted of farm workers involved in ecological/integrated/natural farming.

For consistency purposes resp. for ease of readability, the two groups examined are referred to below by the terms "conventional cultivation/farming" vs. "ecological cultivation/farming" resp. "pesticide users" vs. "non-pesticide users".

2. Material and methods

Study areas and participants

The selection of the study areas and the recruitment of the participants – male small-scale farmers and farm workers – was carried out beforehand with support of several organizations such as ASTAC (Asociación Sindical de Trabajadores Agricolas Bananeros y Campesinos), the "Federation of Unions of banana workers and farmers" which for the last years has been acting as a voice for workers exploited by their employers in the region Los Ríos, and UROCAL (Unión Regional des Organizaciones Campesinas del Litoral), an umbrella organisation of small-scale producers in the southern coastal region of Ecuador.

Questionnaire

The forms were based on standardized questionnaires adapted to local conditions (e.g. methods of pesticide application). The data collected included socio-demographic features, symptoms (acute and chronic health problems) and indicators of exposure such as working conditions (pesticides applied, safety measures etc.) and housing situation (proximity to cultivation area etc.).

The forms for the exposed group consisted of 39 questions (122 response options resp. items), those for the control group included 27 questions (89 items). Data were collected using face-to-face interviews conducted by interviewers from the study areas which were specifically trained for the project by the research team.

Human Biomonitoring

To perform the Micronucleus assays (Buccal Micronucleus Cytome Assay), used to study genotoxic or cytotoxic changes, simple swabs of the buccal mucosa are taken (left and right cheek separately) with wooden spatulas (Tolbert et al. 1992). This non-invasive examination method is painless and involves no risks for the participants. Subsequently, the material collected is spread on microscope slides labelled with the corresponding code number and later fixed and stained (Schiff's reagent). The further assessment of the cells, a very demanding task, will be performed by experienced experts in an appropriate laboratory in Vienna after preparation according to the protocol of Thomas et al. (2009).

Examination procedure

Before the examination, the workers were informed about the methods and the procedure. After registration and allocation of a code for anonymization purposes, weight and size of the study participants were measured. Then the buccal swabs were taken and the medical questionnaire was administered.

Statistical methods

The questionnaire data were evaluated descriptively. Absolute and percentage frequencies (within the groups of pesticide users and non-pesticide users) were calculated for categorical data and mean, standard deviation, median and interquartile range for quantitative data.

Categorical data for the two groups were compared with the Chi-squared test or Fisher's exact probability test (for binary categories), quantitative data with the Mann-Whitney-U-test. Symptoms were analysed by logistic regression with age and school education as covariates. Nagelkerke's pseudo R^2 was used to determine the differences in the occurrence of symptoms explained by each model.

P-values below 0.05 (5 percent level of significance) are considered as statistically significant, p-values below 0.01 (1 percent level of significance) as highly significant.

The questionnaire data were evaluated first. In a further step, depending on the provision of financial support, the buccal mucosa cells will be analysed and medically assessed in connection with the questionnaire data.

3. Results of the questionnaire survey

Data were collected at five different locations in two banana production regions in Ecuador in October 2015: three tests in the Province Los Rios (Quevedo, La Unión, Valencia), two tests in the Province El Oro (La Libertad, Buenavista) (Table 1).

Table 1
Study areas and number of participants.

Survey location	Number of participants	Date of examination
Quevedo	10	26/10/2015
La Unión	7	27/10/2015
Valencia	17	28/10/2015
La Libertad	23	29/10/2015
Buenavista	14	30/10/2015

A total of 71 farm workers were surveyed, with 34 persons involved in conventional farming (pesticide users, so-called "cases") and 37 persons in ecological farming (non-pesticide users, so called "controls"). After a review of the data, three farm workers from the group of pesticide users were not included in the analyses because they indicated not to use pesticides. Thus the sample comprised a total of 68 participants.

3.1. Group comparisons

As to socio-demographic (age, household size) and anthropometric (size, weight) features, no important differences between the two groups were found. The parents of the participants work(ed) predominantly in agriculture. Mean age was 45/46 years.

The two groups differed significantly both in terms of current use and lifetime use of pesticides (p=0.001) (Table 2).

The two groups also differed significantly with regard to their level of education. While in group 1 (pesticide users) 6 persons reported no school education, in group 2 there was only one person without school education. In contrast, 14 persons from the control group had attended a higher school, in group 1 only 6 persons.

Table 2
Overview on several socio-demographic variables, significant results in bold.

	Pesticide users	Non-pesticide users	p-value
Age	45.9±13.4	44.7±16.6	0.748
Number of own children	2.8±2.3	3.1±2.2	0.616
Number of persons in household	4.4±2.0	4.1±1.6	0.484
Pesticide use (years)	**12.9±9.5**	**4.9±8.9**	**0.001**
Size (cm)	164.9±4.8	165.6±5.6	0.594
Weight (kg)	69.4±10.7	69.6±11.2	0.940
Mother working in agriculture (%)	35.5 %	54.1 %	0.124
Father working in agriculture (%)	80.7 %	78.4 %	0.818

3.2. Indicators of exposure

The exposure to pesticides applied by/sprayed from airplanes was assessed as follows: How often is aerial spraying of pesticides directly above them or in their proximity observed by the study participants? Furthermore it was asked whether they were able to perceive pesticides as a smell or as moisture on the skin at these events. It was found that the group of pesticide users was also exposed more often to pesticide impacts from aerial spraying. Thus the regions where the two groups work differ also considerably in terms of exposure to aerial pesticide application. The results are shown in Tables 3 and 4.

Table 3
Frequency of observations of aerial pesticide application in percent.

Aerial spraying observed	Pesticide users	Non-pesticide users	p-value
Never	0.0	24.3	0.001
Once per month	16.1	40.6	
Once per week	54.9	24.32	
More than once per week	25.8	0.0	
Daily	3.2	10.8	

Table 4
Frequency of effects observed (smell, moisture on skin) in percent.

Perceptions (smell, moisture)	Pesticide users	Non-pesticide users	p-value
Never	0.0	27.6	0.001
In less than half of the cases	25.8	6.9	
In more than half of the cases	0.0	10.3	
Always	74.2	55.2	

3.3. Pesticides – attitudes and knowledge

The two groups demonstrated a highly significant difference with regard to their assessment of the harmfulness of pesticides to health and to the environment.

Table 5
Assessment of harmfulness to environment and health in percent.

Assessment	Pesticide users	Non-pesticide users	p-value
Not harmful	9.7	5.4	0.001
Moderately harmful	90.3	16.2	
Very harmful	0.0	78.4	

With regard to alternatives to chemical/synthetic pesticides, non-pesticide users had considerably more knowledge about the use of biopesticides and the possibilities of organic cultivation than the control group. Knowledge of crop rotation, used to maintain soil fertility, and intercropping did not differ statistically (Table 6).

Table 6
Responses in percent to the question on known alternatives to chemical/synthetic pesticides.

Alternatives	Pesticide users	Non-pesticide users	p-value
Biopesticides	3.2	40.5	<0.001
Organic farming	25.8	100.0	<0.001
Crop rotation/sequencing	12.9	29.7	0.089
Cultivating crop mixtures	29.0	21.6	0.482

3.4. Handling of pesticides

The question whether spraying of pesticides is dangerous to health or not was answered in the affirmative by almost all participants from both groups (2 negative answers by non-pesticide users).

Responses of the group of farm workers in conventional agriculture (n=31) on questions surrounding the application/handling of pesticides are presented below.

An overview of the responses of the participants regarding total duration of pesticide use is shown in Table 7.

Table 7
Responses on duration of pesticide use.

Years	%	Years	%
1	16.1	12	6.5
2	6.5	16	6.5
4	38.7	20	6.5
8	9.7	30	9.7

For about 81 % of participants the last spraying was at most 3 weeks ago.

14 participants were not able to provide information on the type of agrochemicals they used. The pesticides mentioned by the other 17 participants are mostly herbicides and fungicides, followed by insecticides. The herbicides applied were in almost all cases organophosphates (one exception: bipyridines). Among the fungicides, tiabendazoles were mentioned most often, but also imidazoles, carbametes and chlorothalonil. Only two participants mentioned insecticides belonging to the group of organophosphates (Mocap© [active substance Ethoprop]).

Thus overall, pesticides from the group of organophosphates are the predominant type (applied by 8 participants).

Two thirds of the participants (67.7 %) prepare the pesticide mixtures themselves.

During active application (spraying), a predominant part never uses masks or gloves. Only 19.4 % of the respondents use masks/gloves all the time; one person for less than half of the time.

The main reason for not using protective equipment, indicated by 67.7 % of the respondents, was that neither masks nor gloves were available (Table 8).

Table 8
Reasons for not using masks or gloves.

Reasons for not using protective equipment	Number	Percentage
Not available	21	67.7
Uncomfortable	3	9.7
Mask not necessary	4	12.9
Not specified	3	9.7

As to the time of hand washing after spraying, the majority of the participants said that they apply this hygiene measure on the spot, i.e. while still on the plantation. Nobody is washing their hands before going to bed (Table 9).

Table 9
Frequencies of hand washing at different points of time after working with pesticides.

	On the field	Immediately when coming home	Later at home	Before going to bed
Never	-	61.3	93.5	100.0
< half of the time	19.3	3.2	-	-
> half of the time	19.3	9.7	-	-
Always	61.4	25.8	6.5	-

Clothes are changed immediately after work by about 61 % of the respondents.

All farm workers surveyed stated that they keep their spraying canisters resp. equipment outside of their own homes.

In about 90 % of the cases, equipment is cleaned outside of the garden/the yard. Three persons indicated to clean the equipment in a body of water nearby (e.g. creek, river).

On the question on how pesticides residues are dealt with, a third each stated to dispose of them in the garden/yard or in a river (Table 10).

Table 10
Disposal of pesticide residues.

	Frequency	Percent		Frequency	Percent
No residues	2	6.5	Trash	4	12.9
In the garden	11	35.5	Burning	1	3.2
In a river	11	35.5	Re-use	2	6.5

Empty pesticide containers are not used for other purposes (e.g. for keeping food).

About 71 % of farm workers live more than 1 km away from the plantation where they work.

The following reasons for using/spraying pesticides were stated: Instruction of the superior (70.9 %), good for the plants (45.2 %), less effort (41.9 %), higher yield (38.7 %).

The question whether they would stop using pesticides if they would get the same pay was answered in the affirmative by about 39 % of this group.

3.5. Symptoms

The questionnaire covered the occurrence of 19 different symptoms in the last six months which can be indicative of possible toxic effects by pesticides. Two categories of effects can be distinguished: (1) local irritation symptoms and (2) systemic effects.

The following symptoms were included: Headache, vision problems, dizziness, strong fatigue, exhaustion, sleeplessness, nausea/vomiting, stomach pain, diarrhea, excess salivation, burning eyes, skin irritations, skin rashes, runny nose, watering eyes, breathing difficultiess, cough, irregular heartbeat, twitching/trembling. The results of a first exploratory analysis, taking only age and education level into account, are shown in Table 11.

The symptoms

- Dizziness
- Vomiting, diarrhea
- Burning eyes, skin irritations
- Strong fatigue, sleeplessness
- Irregular heartbeat

were reported considerably more often by pesticide users than by non-pesticide users.

Table 11
Self-reported symptoms of participants; results of the logistic regression analysis controlling for age and educational level; significant results in bold. OR = Odds ratio (control group = 1).

Symptom	OR	95 % CI	p-value
Headache	1.47	0.54 – 4.05	0.453
Vision problems	0.79	0.28 – 2.18	0.643
Dizziness	**4.80**	**1.55 – 14.87**	**0.007**
Nausea, vomiting	**7.50**	**1.77 – 31.77**	**0.006**
Excess salivation	1.82	0.61 – 5.39	0.281
Strong fatigue	**4.96**	**1.65 – 14.88**	**0.004**
Exhaustion	2.53	0.88 – 7.28	0.086
Stomach pain	2.22	0.76 – 6.53	0.147
Diarrhea	**6.43**	**1.06 – 39.00**	**0.043**
Sleeplessness	**3.39**	**1.16 – 9.87**	**0.025**
Burning eyes	**4.10**	**1.37 – 12.31**	**0.012**
Skin irritations	**3.58**	**1.10 – 11.71**	**0.035**
Runny nose	2.79	0.77 – 10.11	0.119
Breathing difficulties	2.83	0.80 – 9.99	0.105
Irregular heartbeat	**5.75**	**1.08 – 30.67**	**0.041**
Watering eyes	3.12	0.98 – 9.95	0.055
Skin rashes	3.38	0.71 – 16.11	0.126
Cough	2.10	0.66 – 6.67	0.209
Twitches, trembling	3.58	0.52 – 24.61	0.195

The next step was to examine whether self-reported health symptoms are related to any of the indicators of exposure. It was found that duration and frequency of pesticide application is associated with several symptoms. Due to the low number of cases, these results should be seen as exploratory findings only. Yet it can be assumed, overall, that both the intensity and the duration of the pesticide application play a role in the development of health symptoms.

Table 12
Logistic regression with frequency of observations of aerial spraying, smelling/sensing pesticides and interaction of frequency and smelling/sensing, age as covariate.

Symptom	Nagelkerke's pseudo R^2	Depends on
Headache	0.053	-
Vision problems	0.137	t smelling/feeling
Dizziness	0.268	** smelling/ feeling
Nausea, vomiting	0.296	** smelling/ feeling when observed frequently
Excess salivation	0.209	* smelling/ feeling
Strong fatigue	0.224	* smelling/ feeling + frequency
Exhaustion	0.078	-
Stomach pain	0.168	* smelling/ feeling when observed frequently
Diarrhea	0.270	-
Sleeplessness	0.206	** smelling/ feeling
Burning eyes	0.071	t smelling/ feeling
Skin irritations	0.272	* smelling/ feeling when observed frequently
Runny nose	0.262	t smelling/ feeling
Breathing problems	0.069	-
Irregular heartbeat	0.301	t frequency
Watering eyes	0.213	* smelling/ feeling
Skin rashes	0.256	* smelling/ feeling
Cough	0.127	-
Twitches/trembling	0.261	* smelling/ feeling

t = tendency ($p<0.1$); * significant ($p<0.05$); ** highly significant ($p<0.01$)

Furthermore, we examined whether the exposure indicators “observations of aerial spraying” and “olfactory and dermal perceptions” (perception of smells and on the skin indicating spraying events) are related to the self-reported symptoms of **both** groups. The results of the analysis are shown in Table 12.

The results of this analysis can be summarized as follows: (Frequent) observations of aerial spraying of pesticides and the presence of corresponding perceptions (smell, moist skin) have a (highly) significant association with the occurrence of a range of acute symptoms. This means that the health of both groups is affected by aerial spraying. Differences between the two groups are thus reduced, but pesticide users could be at an even higher risk to experience some of the symptoms compared to completely unexposed controls.

4. Medical assessment

The aim of the study was to examine possible relationships between indicators of exposure and health effects with regard to the different cultivation methods.

A total of 71 farm workers with a mean age of 45/46 years participated in the study. With regard to physiological attributes, there were practically no differences between the two groups. In the statistical analysis (logistic regression), differences in socio-demographic features (educational level, material possessions) were controlled for. The two groups differed considerably with regard to pesticide exposure (both in terms of own application and exposure through aerial spraying, see below). This is an essential prerequisite for examining possible group-specific differences, for example in terms of the occurrence of symptoms.

Assessing exposure to pesticides proved to be a special challenge for the study. Pesticide users are exposed to biocides through two routes (own application and aerial spraying). Yet non-pesticide users are also affected by aerial spraying (through drift). This overlap may lead to smaller differences between the groups with regard to health symptoms.

Our analysis showed that pesticide impacts (moisture on the skin or smell) are perceived considerably more often by pesticide users than by non-pesticide users. In addition, the regions where the two groups work differ considerably in terms of exposure to aerial spraying (see Tables 3 and 4).

It has to be noted that this method of application is banned in the European Union since 2009 (reasons: pesticide drift etc.), with a deadline for implementation by 2011, and only allowed in exceptional cases. Health risks are a concern in such cases: If the area to be sprayed is in close proximity to areas open to the public, specific risk management measures are included in the approval to prevent adverse effects on the health of bystanders. The area to be sprayed may not be in close proximity to residential areas (Directive 2009/128/EC). Yet in the regions of the present study, such precautionary measures are not common practice.

The participants were asked about any health symptoms experienced in the last six months. The results demonstrate significant differences between the two groups: Both local irritation symptoms and systemic effects were considerably more frequent in pesticide users. This indicates that the use of pesticides is associated with acute adverse health effects in farm workers. For example, pesticide users had a 6 to almost 8-fold increased risk for reporting gastrointestinal symptoms (mostly nausea, vomiting, diarrhea) than non-pesticide users.

4.1. Pesticides used

The extensive use of pesticides in conventional farming, in particular in the Global South, is well documented (Ecobichon 2001). Among them are active substances already banned or soon to be banned in the European Union. An example is Paraquat (Gramoxon©), mentioned by pesticide users in existing studies and banned in the EU since 2007 (European Commission 2007).

Pesticides applied by farm workers in conventional agriculture include chemicals suspected to be carcinogenic, in first line glyphosate (Roundup©). The International Agency for Research on Cancer (IARC) has classified glyphosate as a substance of Group 2A (probably carcinogenic to humans) (IARC 2015, Guyton 2015). Not less than 8 of 17 farm workers indicating specific pesticides said that they are using this herbicide. Also named was Ethoprop, another highly toxic pesticide belonging to the group of organophosphates and classified as probably carcinogenic to humans by the U.S. Environmental Protection Agency (2006).

This is another confirmation that substances hazardous to health are used in conventional farming, usually also without taking any measures to protect the workers (see below).

A cause for concern is the high number of persons with no apparent knowledge about the pesticides they were applying. This may be based on actual ignorance or on the reluctance of participants to provide any information in this regard (various apprehensions).

Due to the relatively low number of persons (n=14) who indicated which pesticides they were applying/using, a statistical analysis of possible relationships between pesticides used and health symptoms experienced is not possible. In any case it has to be emphasized that the group of active substances most frequently mentioned was the group of organophosphates. It can be assumed, therefore, that an equal number of these products is also used by the group of farm workers not indicating any pesticides.

4.2. Protection measures

Absorption of pesticides in occupational exposure may occur in particular during preparation of mixtures and spraying/vaporizing. Organophosphates, for example, are absorbed through the skin and the respiratory tract. From the perspective of occupational medicine, therefore, first priority should be given to (simple) measures to reduce exposure, apart from using less toxic products. Such measures include appropriate personal equipment to protect the respiratory organs, eyes and hands.

Although almost all pesticide users surveyed acknowledge that pesticides are harmful to health, only 20 percent of the respondents always use masks and/or gloves. A main reason for this inadequate use of personal protective measures is that masks and gloves are not available and/ or not provided by employers. As to why this happens, two reasons strongly suggest themselves: either ignorance or denial of the health risks involved or a reluctance of employers to provide this safety equipment out of organizational or financial considerations, though they have an obligation to do so. In any case, such deficiencies are reported frequently from countries of the Global South (e.g. Okonya & Kroschel 2015, Antwi-Agyakwa et al. 2015).

4.3. Further steps

A reduction in the use of pesticides, i.e. switching to natural cultivation methods, would both improve the health status of the local farming population and the quality of the products. This is in line with the objective of protecting health and safety in Austria.

In our previous study on pesticide impacts on farm workers in Latin America, we found an increased frequency of chromosomal damage in buccal mucosa cells (Hutter et al. 2015). Thus such human biomonitoring methods were also used in this study. The assessment of the cell samples taken, a complex and demanding task, is in progress. The results of the analysis of the buccal mucosa cells are expected to contribute to a clarification whether relationships between indicators of exposure and possible long-term health effects (possible cancer risk in farm workers) exist in regard of the different cultivation methods.

The aim of the campaign is to contribute to an improvement of the health-threatening working conditions (better safety measures, a reduced or no use of pesticides) by exerting more pressure on supermarkets and thus on the employers of farm workers.

Representative population surveys show that there is a strong public interest in the issue “pesticides in food” in Europe. Pesticide residues in food are generally perceived as a health risk. Systematic reviews demonstrate that environmentally sound food products contain considerable less hazardous substances than conventional food products. This could be a starting point to significantly raise awareness of working conditions in banana producing regions and to improve the situation.

5. References

Antwi-Agyakwa A, Osekre E, Adu-Acheampong R, Ninsin KD (2015): Insecticide use practices in cocoa production in four regions in Ghana. West African Journal of Applied Ecology723:39-48.

Ecobichon DJ (2001): Pesticide use in developing countries. Toxicology 160:27-33.

Damalas CA, Eleftherohorinos IG (2011): Pesticide exposure, safety issues, and risk assessment indicators. Int J Environ Res Public Health 8:1402–1419.

Grandjean P, Harari R, Barr DB, Debes F (2006): Pesticide exposure and stunting as independent predictors of neurobehavioral deficits in Ecuadorian school children. Pediatrics 117:e546-56.

Guyton KZ, Loomis D, Grosse Y, El Ghissassi F, Benbrahim-Tallaa L, Guha N, Scoccianti C, Mattock H, Straif K (2015): International Agency for Research on Cancer Monograph Working Group, IARC, Lyon, France. Carcinogenicity of tetrachlorvinphos, parathion, malathion, diazinon, and glyphosate. Lancet Oncol 16:490-491.

Handal AJ, Harlow SD, Breilh J, Lozoff B (2008): Occupational exposure to pesticides during pregnancy and neurobehavioral development of infants and toddlers. Epidemiology 19:851-859.

Handal AJ, Lozoff B, Breilh J, Harlow SD (2007): Effect of community of residence on neurobehavioral development in infants and young children in a flower-growing region of Ecuador. Environ Health Perspect 115:128-33.

Hutter H-P, Wali Khan A, Ludwig H, Nersesyan A, Shelton JF, Wallner P, Moshammer H, Kundi M (2015): Cytotoxic and genotoxic effects of pesticide exposure in male coffee farmworkers, Dominican Republic. In: Abstracts of the 2015 Conference of the International Society of Environmental Epidemiology (ISEE). (Sao Paulo, Brazil, 30.08.-03.09.2015) Abstract [572].

International Agency for Research on Cancer (IARC) (2015): Volume 112: Some organophosphate insecticides and herbicides: tetrachlorvinphos, parathion, malathion, diazinon and glyphosate. IARC Working Group. Lyon; 3–10 March 2015. IARC Monogr Eval Carcinog Risk Chem Hum (in press).

European Commission (2007): The Court of First Instance annuls the Directive authorising Paraquat as an active plant protection substance. Judgment of the Court of First Instance in Case T-229/04 Press Release No° 45/07 11 July 2007;

http://curia.europa.eu/jcms/upload/docs/application/pdf/2009-02/cp070045en.pdf

Laborde A, Tomasina F, Bianchi F, Bruné MN, Buka I, Comba P, Corra L, Cori L, Duffert CM, Harari R, Iavarone I, McDiarmid MA, Gray KA, Sly PD, Soares A, Suk WA, Landrigan PJ (2015): Children's health in Latin America: the influence of environmental exposures. Environ Health Perspect 123:201-209.

Muñoz-Quezada MT, Iglesias V, Lucero B, Steenland K, Barr DB, Levy K, Ryan PB, Alvarado S, Concha C (2012): Predictors of exposure to organophosphate pesticides in schoolchildren in the Province of Talca, Chile. Environ Int 47:28-36.

Okonya JS, Kroschel J (2015): A cross-sectional study of pesticide use and knowledge of smallholder potato farmers in Uganda. Biomed Res Int. 2015:759049.

Oudbier AJ, Bloomer AW, Price HA, Welch RL (1974): Respiratory route of pesticide exposure as a potential health hazard Bulletin of Environmental Contamination and Toxicology 12:1-9.

Perry MJ, Layde P (1998): Sources, routes, and frequency of pesticide exposure among farmers. Journal of Occupational & Environmental Medicine 40:697-701.

Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

(Directive on plant protection products)

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0071:0086:en:PDF

Thomas P, Holland N, Bolognesi C, Kirsch-Volders M, Bonassi S, Zeiger E, Knasmüller S, Fenech M (2009). Buccal micronucleus cytome assay. Nat Protoc. 4(6):825-37.

Tolbert P, Shy CM, Allen JW 1992. Micronucleus and other nuclear anomalies in buccal smears: Methods development. Mut Res 271:69-77.

US EPA Office of Pesticide Programs, Health Effects Division, Science Information Management Branch (2006): Chemicals Evaluated for Carcinogenic Potential. April 2006 http://npic.orst.edu/chemicals_evaluated.pdf.

6. Appendix

Additional information

Südwind, a non-governmental organization in the field of development policy, has been advocating sustainable global development, human rights and fair working conditions worldwide for more than 35 years. Through educational work in schools and out-of-school education, the monthly journal Südwind Magazin and other publications, Südwind aims to raise public awareness of global interdependence and its consequences in Austria. Through attention-grabbing actions, campaigns and information activities, Südwind strives for a more equitable world. www.suedwind.at

The campaign "Make Fruit Fair!" is a three-year-project in which Südwind and 19 other partner organizations are promoting fair working conditions, sustainable development and fair trade practices in the production of fruits. Non-governmental organizations (NGOs) from all over Europe are working in close partnership with organizations of small farmers and unions of plantation workers from Africa, Latin America and the Caribbean. The aim is to improve living and working conditions of those people who grow, pick and pack the tropical fruits we buy every day. Specifically, the campaign calls for supermarkets, as the most powerful actors along the supply chain, to pay fair prices to their suppliers that cover the costs of sustainable production and to protect the environment by reducing the use of toxic agrochemicals. Governments should prevent supermarkets from abusing their buying power and ensure that companies can be held accountable for working conditions in producing countries. www.suedwind.at resp. www.makefruitfair.org

UROCAL is an umbrella organization of small-scale producers in the southern coastal region of Ecuador. The provinces Guayas, Azuay and El Oro constitute one of the most important banana growing regions in the country. UROCAL, the "Regional Union of Farmers' Organizations of the Coastal region", unites and represents about two dozen village cooperatives, producers' organizations, women's committees and a credit cooperative with more than thousand members. The origins of this umbrella organization reach back to the battle for land rights in the 1960ies. Most of the farmer families cultivate areas ranging from one to 15 hectare in the coastal strip between the harbour cities Guayaquil and Machala. The banana farmers of UROCAL are among the 5,000 smallholders providing about 60 percent of the bananas produced in Ecuador.

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