



Perceptions of Flower Farm Workers on the Health Effects of Chemicals Exposures around Bahir Dar Town, Ethiopia

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Authors' contributions

This work was carried out in collaboration between both authors. Author TGB designed the study, analyzed and interpreted data, wrote the protocol and prepared the first draft of the manuscript. Author TTN managed the analyses of the study and the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: Explore the perceptions of flower farms workers towards the health effects of chemical exposures. Perception is the views, attitudes and opinions of workers.

Study Design: Descriptive survey, using quantitative and qualitative approaches.

Place and Duration of the Study: Tana Flora, Bahir Dar Farm and Tal Flowers, between November 2018 and June 2019.

Methodology: Statistical analyses were done using 302 sample workers (80 male and 222 female; age ranges 15-65 years) at 95% confidence interval employing stratified random sampling techniques via proportional sample selection, and a response rate of 95.6%. Independent sample t-test with the assumption of equal variance (the Leven's t-test) was used to analyze the existence of significant perception differences among female and male workers, and workers labour divisions. Qualitative data was obtained through structured interviews from farms managers (3); regional Environmental, Forest and Wildlife Protection Development Authority (EFWPDA) officials (3) and field observations that supplemented the quantitatively analyzed data.

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Results: Leven's t-test showed the computed p-values were less than the preset significance level (0.05) for the majority of health impacts of chemical exposures. Significant perception differences were observed among male and female workers and workers of different labour divisions (production vs. protection; pack house vs. protection) towards health impacts: skin rash, appetite loss, stomach cancer, birth defects, reproductive system damage, dizziness and impaired sight. Males perceived in a better way than females since farms gave special focus to male workers in the protection section 27(8.9%) and they engaged using the required health protective gears. Further, in flower farms, most of the proposed health impact mitigation measures were poorly implemented.

Conclusion: Workers perception differences were occurred due to a particular attention to male workers in protection labour division; hence the regional EFWPDA should do the proper supervision and follow up for effective implementation of health impact mitigation measures.

Keywords: Workers perception; flower farms; chemicals; labour divisions; workers health; impact; mitigation measures.

1. INTRODUCTION

Currently, Ethiopia has 72 active flower farms engaged in flower production and this flower sector has a significant contribution to the generation of hard currency and employment opportunities [1,2]. But, the socio-economic merits of the flower sector have outweighed its negative health and environmental impacts. Some government officials perceived the environmental and health impacts of the sector are negligible and should not be considered. However, some others believed that the sector has negative health and environmental impacts due to the uses of excessive chemicals, improper waste management and lack of protection [3,4,5, 6,7,8].

The Ethiopian floriculture industry uses up to 127 varieties of chemical fertilizers and pesticides in greenhouses to produce flowers and most of them are pollutants and toxic [7]. Most flower farms produce roses (around 64%), which require the use of a lot of chemicals to control diseases [1,6]. These toxic chemical fertilizers and pesticides applied in flower farms are spreading through volatilization, infiltration, run off, erosion, and wind dispersal [6] and are leaving as a pollutant and affect the health of non-targeted lives like human beings, especially children and women are more susceptible to the effects of pesticides [9,10]. Workers in greenhouses are exposed to these chemicals through their skin and inhalation at different stages of flower growth [7]. It is also indicated that many employees in the flower farms have feelings of pain because of exposures for chemicals, but flower farm workers adapt the smell even though there is frequent vomiting and headache. Among others, chemical spraying

section workers are more exposed to chemicals and thus flower firms provide special health care. In addition, they provide additional incentives in terms of money, milk and better diet [11].

Studies on the floriculture industries of Ethiopia and other countries indicates some of the major health problems caused due to exposures to chemical fertilizers and pesticides were headache, fainting, dizziness, nausea, diarrhea, birth defects, reproductive and nervous system damage, skin lesions and allergies, respiratory and eye problems [4,9,11,6,7,8,12]. Realizing this, Ethiopia has established its national environmental, occupational health and safety strategies and standards to mitigate the impacts of the growing floriculture industry [1,5].

Study on flower farms workers' perception about the health effects of chemical exposures is useful to provide information about whether there are perception differences and/or similarities among male and female workers and workers engaged in different labour divisions. Besides, it serves as base line information for comparative studies conducted on similar issues. Therefore, this study was designed to examine workers perceptions of the health impacts of chemical exposures; and impact mitigation measures as per Environmental and Social Impact Assessment (ESIA) studies and Ethiopian Horticulture Development Agency (EHPEA) codes of practices in the flower farms around Bahir Dar Town.

2. STUDY AREA AND METHODOLOGY

The study was conducted in three flower farms located around Bahir Dar Town (the capital of Amhara National Regional State of Ethiopia).

The first flower farm is Tana Flora PLC, which is approximately located 17 kms along the road from Bahir Dar to Zege Town to South West shore of Lake Tana (Fig. 1).

Bahir Dar farm PLC is the second one that is located about 18 kms along the road from Bahir Dar to Woreta Town to North East shore of Lake Tana, and both farms produce roses. Tal Flowers PLC flower farm which is approximately located 14 kms along the road from Bahir Dar to Meshenti Town to South West of Bahir Dar Town and produces summer flowers (Fig. 1).

Data from human resources of the three flower farms of four labour divisions (production, pack house, protection, and general) indicated that a total of 1337 workers/employees have been directly engaged in flower production process and were eligible for the study due to exposures to chemicals at different stages of flower production process.

A descriptive study design was employed using quantitative and qualitative methods to examine flower farm workers perceptions towards the health impacts of chemical exposures. Regarding sample size, the initial sample size (n) for infinite

population was determined using the standard formula of Cochran [13], $n = \frac{DEFF \cdot Z^2 \cdot (p)(1-p)}{d^2}$, where DEFF=1 is Design Effect of the study, Z is the level of statistical significance from the value of normal probability distribution corresponding to a confidence level of 95% (Z=1.96), p is percentage of picking a choice in a best case scenario (p=0.5) and d is desired level of absolute precision (d=0.05). Then, the initial sample size was corrected by considering the finite population and was calculated using the formula $N = \frac{n}{1 - \frac{n}{P}}$, where n is the initial sample size (384) and P is total population (1337). The final sample size which has been computed through considering finite population was adjusted by expected non-response rate of 5% (0.05) and was computed using $N' = \frac{N}{1 - 0.05}$ and the final sample size of the study was 316.

The sample units were selected in the four labour divisions systematically using random starting point from the prospective flower farms labour division workers list to get individual participants and were allocated proportionally with respect to the power of a size of workers in the three flower farms of the four labour divisions.

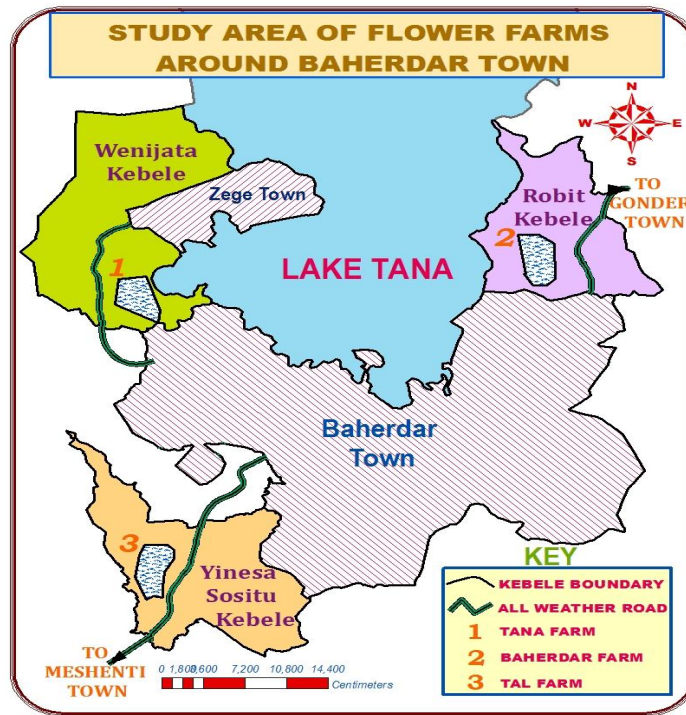


Fig. 1. Location map of the study areas

Source: Central Statistical Agency, Cartographic Census shape file, 2019

Since the main focus of this study was to examine opinions and beliefs of the respondents about an issue, a five point likert scale is more suitable and viable for this study [14] to collect the required quantitative data from workers composed of Strongly Disagree (SD) (1), Disagree (D) (2), Uncertain (U) (3), Agree (A) (4), and Strongly Agree (SA) (5) and were designed based on similar studies (Workneh, 2007; Degytnu, 2012; NAPE, 2012; Atkure, 2013 and Adugna, 2017). Guiding checklists were also used to collect qualitative data from farms' managers, and the relevant Amhara Regional State EFWPDA officers. Data collected through administered questionnaires from workers were analyzed quantitatively with the help of Statistical Packages for Social Science (SPSS) version 23 using descriptive and inferential statistics at 95% confidence interval. Inferential statistics like independent sample t-test was used to analyze the existence or non-existence of significant difference in the workers perceptions among sex and labour divisions. An assumption of variance was identified using the Leven's t-test and equal variances were assumed for all health impact indicator items.

The composite score for a five point likert scale was analyzed at the interval measurement scale since the data analysis procedure is appropriate for descriptive statistics (mean and standard deviation) and independent sample t-test [15,16, 17,18]. To calculate the mean score on the five point likert scale, each length of the scale has to be assigned with a range of intervals. The range is calculated as $(SA - SD)/SD$, $(5 - 1)/5 = 0.8$ (greatest value of the scale). The least value in the five point likert scale is 1 and is added to get the maximum of the five point scale. Thus, the mean score ranging from 1 to 1.80 represents Strongly Disagree; 1.81 to 2.60 represents Disagree; 2.61 to 3.40 represents Uncertain; 3.41 to 4.20 represents Agree; and 4.21 to 5.0 represents Strongly Agree.

3. RESULTS AND DISCUSSION

3.1 Socio-demographic Characteristics of Study Participants

The total sample size of workers believed to be involved in the study was 316. Out of this, 302 were properly responded and returned the questionnaire. The statistical analyses were done based on 302 sample workers from the three flower farms and the return rate was 95.6%. Among the remaining proportion, eight of them

didn't return the questionnaire and the others were refusals. The result indicated that the actual non-response rate was equivalent to the amount that was calculated during the design stage.

Table 1 shows the socio-demographic characteristics of study participants in terms of sex, age, educational level, work experience, and labour divisions. The study revealed that most of study participants were females 222 (73.5%), with 1:3 a male to females' ratio. Since female workers are more preferred than males in flower production tasks related to propagation, harvesting, bunching, sorting, and grading of flowers. The age group ranges from 18-30 years is 281 (93%) that constituted the majority. Regarding educational level, most study participants attended primary education 144 (47.7%), while the rest were illiterates 12 (4%), and read and write 12 (4%) that covered smallest shares. One hundred and eight workers (35.8%) had experience from 1 year to 2 years and 105 (34.8%) from 3 to 4 years, while 44 (14.6%) had experience < 1 year and 45 (14.9%) had experience > 5 years. Thus, most study participants were less experienced and low educated young females. This suggested that flower farms have created employment opportunities to less educated young women's.

Regarding labour divisions (LDs), 148 (49%) of study participants were working in production LD; 86 (28.5%) pack house; 41 (13.6%) general and 27 (8.9%) were from protection LD (Table 1). Thus, most participants of the study were females from production and pack house labour divisions, while males from protection LD had smallest shares in the study area. This implied that flower farm activities prefer more number of females than males.

The Bronze Level Codes of compliance (a compliance that flower farms should fulfill to engage in national flower production sector) indicates that unlike females, males in protection LDs of flower farms were allowed to perform any task in chemical and spraying sections and other areas identified as hazardous. Furthermore, children whose age is 15 years and below are not permitted to perform any task in the farm, in any circumstances, and persons working with pesticides must be at least 20 years old [19]. In flower farms, therefore, to some extent gaps have been observed towards the practicality of Bronze Level Codes due to the lack of strict considerations of age and sex factors during workers employment and labour division

engagements. Therefore, flower farms should consider the age and sex of employees as screening criteria during employment and labour division engagements time in order not to jeopardize the health employees.

3.2 Workers' Perception towards the Health Impacts of Chemicals

Knowing the perceptions of workers is important to get information about the health impacts of chemical exposures and helps to take proper impact mitigation measures while the floriculture sector is expanding in the country.

Table 2 depicts description of selected health impacts of exposures to chemicals in flower farms. The grand mean (3.60) in Table 2 showed that workers agreed exposures to chemicals had adverse health impacts.

At a particular level, the data from Table 2 showed that workers agreed exposures to chemicals that could cause respiratory problems like sneezing and shortness of breath; skin rash, headache, vomiting, dizziness, and appetite loss. Flower farms managers as key informants indicated that flower farms used at least 50 types of chemicals (fertilizers and pesticides) for flower production and exposures to these chemicals made workers to be vulnerable to health problems like skin and eye irritations, headache and vomiting. In support of this, Solomon [8] indicated that, the majority of pesticides and chemical fertilizers applied on flower farms are volatilized and are leaving as a pollutant. Workers in greenhouses are exposed to these chemicals through their skin and inhalation at different stages of flower growth [7,20]. For instance, a study conducted on the flower farm employees of Sebeta town and the surrounding areas by Atkure [7] found out that 67.70% of workers had at least one skin problems (eczema, itching, redness, and burning) and 81.10% had at least one respiratory health problems, such as sneezing, shortness of breath, cough, wheezing, chest tightness, and asthma. The study further indicated that, the proportion of study participants with other health symptoms due to pesticide poisoning were headache (73.4%), dizziness (56.9%), irritation of the nose (40.3%), irritation of the eye (37.7%), loss of appetite (35.5%), irritation of the throat (28.2%) and fainting (13.7%).

The data from Table 2 also indicated that workers were uncertain about the impacts of

chemicals that caused impaired sight, stomach cancer, birth defects and reproductive system damage and nervous system damage. But, literatures from the Ethiopian floriculture sector and other countries evidenced that some of the major health problems caused due to exposures to chemicals are headache, dizziness, appetite loss, stomach aches, vomiting, diarrhea, skin allergies, respiratory problems (asthma, pneumonia, bronchitis, sinus), sight problems, stomach cancer, birth defects, reproductive and nervous system damages [14,5,9,7,12,20]. Therefore, perception gaps were observed among the sample workers towards impaired sight, stomach cancer, birth defects and reproductive system damage and nervous system damage.

Regarding the protection of workers health from the impacts of chemical exposures, farm managers explained that except protection labour division workers, all workers in the production, pack house and general work divisions were not provided the necessary safety tools due to scarcity, but protective cloths were accessed by all. A special care was also given to protection section workers through the provision of incentives like additional money, soap, milk, and bread. Besides, due to lack of clinics in the farms, workers were forced to get medical treatments outside the farms in far located governmental and private health institutions. This shows that farms had given special attention mainly for the protection labour division workers, while the majorities were neglected. With regard to the practicality of health protective measures of Environmental and Social Impact Assessment (ESIA) studies and Bronze level codes of compliance, farm managers replied that, even though farms have such documents that provides them to take the necessary health protective measures, farm activities were not operated as per these documents. Besides, Environmental and Social Impact Assessment (ESIA) documents are not yet reviewed since they did not get any support from the concerned regional and federal institutions. But, farms get some support from Ethiopian Horticulture Development Agency (EHPEA) in terms of trainings related to environmental management and safety tools.

Similarly, risks related to occupational health and safety impact assessment evaluations were not conducted due to lack of environmentalists in the farms. Moreover, the Amhara Regional State relevant regional Environmental, Forest and Wildlife Protection Development Authority

(EFPDA) officers explained that yet there are no monitoring and support activities that have been started in flower farms. This implies that the authority has given little attention to workers protection of safety in the flower farms. Field observations also revealed that workers performed their duties without using the necessary protective devices and were exposed to the effects of chemicals such as Ammonium Phosphate, Apollo, Nissorum, Previcur Flex, Equation Pro, Allitte Flash and Folio Gold. This indicates that flower companies seems not concerned in protecting workers' health from the effects of chemicals rather they capitalize on protecting flowers from different diseases. However it is a mandatory requirement that flower companies should provide all the appropriate personal protective devices, such as protective cloths, masks, gloves, safety goggles and shoes, and training on safety issues to all workers to protect from the effects of chemicals as per flower farms ESIA studies and Bronze level codes of compliance.

Besides, employees' perception of their working environments depends on what they practice, observe, hear, and interpret into a meaningful picture although perceptions of individuals can be different and/or similar due to individual life experiences, educational levels, work position and experience [21]. In this study, workers taken as a sample were independent of each other and differ in their sex and labour divisions (LD). To check whether there is perception difference or similarity among workers' towards the health impacts of chemical exposures, comparison were made among workers' sex and LD. Here, the general work LD was excluded in this test since workers in general LD were used as a backup, which have been rotated in other labour divisions as they were assigned.

As it could be inferred from the mean values indicated in Table 3, since both groups had mean differences there were perception difference. Males perceived all the health impact indicator items more than females. On the other hand, females perceived the health effects of chemical exposures, such as sneezing and shortness of breath, skin rash, headache, vomiting, dizziness, and appetite loss, but they were uncertain about the impacts of chemicals that caused birth defects and reproductive system damage, stomach cancer, impaired sight and nervous system damage (Table 3).

Thus, in the study area, male workers perceived the health impacts of chemicals in a better way

than females. This was due to the nature of their working environment, in that males has got a special attention and adequately protected from the effects of chemicals. According to Adugna [12] pesticides and chemical fertilizers can cause cancer, birth defects, reproductive and nervous system damage. For instance, chemical fertilizer like nitrates can cause stomach cancer, even though there is no conclusive evidence and the intensity of this threat is unidentified [12]. High amount of nitrates used in drip irrigation can also cause impaired sights. But, young females as main participants of this study were uncertain about the health effects of chemicals towards birth defects and reproductive system damage, stomach cancer, impaired sight and nervous system damage.

To decide whether there is significant perception difference or similarity, the collected data was analyzed using independent sample t-test among workers' characteristics of sex and labour divisions. When the computed p -value is less than the preset significance level (0.05), there is significant difference between the two group means, while in the reverse case significant difference does not exist [14]. Thus, the summary result is described from Tables 4 to 6.

As indicated in the Table 4, except item #1, the computed 2-tailed significance levels (p -values) were less than the present level of significance (0.05). It is therefore possible to decide that there was perception difference between the two groups at the above mentioned t -values. From this, it can be said that, there was significant perception difference due to workers sex towards the majority of health impacts of chemical exposures. Since male workers were involved in the areas of chemicals, flower farms gave special attention and allow them to engage through the required safety tools; they could perceive the health impacts of chemicals in a better way than females.

As shown in the Table 5, for the eight health impact indicator items (i.e., item #2, #3, #4, #6, #7, #8, #9 and #10), the computed 2-tailed significance levels (p -values) is less than 0.05. The existing mean perception difference between the two labour divisions was significant at the above mentioned t -values. Therefore, there were significance mean perception differences to the majority of health impact indicator items between production and protection section workers. This perception differences were happened due to a special attention given to protection workers.

Table 1. Socio-demographic characteristics of study participants

Characteristics	Count	%	Characteristics	Count	%	Characteristics	Count	%
Sex			Educational status			Work experience		
Male	80	26.5	Illiterate	12	4	Below 1 year	44	14.6
Female	222	73.5	Read and Write	12	4	1-2 years	108	35.7
Age			Primary (1 – 8)	144	47.7	3-4 years	105	34.8
Below 15	1	0.3	Secondary (9-12)	85	28	Above 5 years	45	14.9
16-17	14	4.6	Technical and Vocational Education	21	7	Labour divisions		
18-20	133	44	Diploma	18	6	Production	148	49
21-30	148	49	Degree and above	10	3.3	Pack House	86	28.5
31-40	4	1.3				Protection	27	8.9
41-50	1	0.3				General	41	13.6
51-65	1	0.3						

Source: Own Survey, 2019

Table 2. Health impacts of chemical exposures as responded by flower farm workers

Health impacts of chemical exposures	N	Mean	Standard deviation
Exposures to fertilizers and pesticides cause vomiting.	302	3.80	0.93
Exposures to pesticides cause sneezing and shortness of breath.	302	3.95	1.00
Exposures to pesticides and fungicides cause skin rash.	302	3.87	0.94
Exposures to pesticides cause appetite loss.	302	3.65	1.10
Exposures to chemical fertilizers and pesticides cause headache.	302	3.81	1.02
Exposures to fertilizers and pesticides cause stomach cancer.	302	3.28	1.00
Exposures to pesticides cause birth defects and reproductive system damage.	302	3.35	1.26
Exposures to pesticides can damage the nervous system.	302	3.38	0.95
Exposures to chemical fertilizers and pesticides cause dizziness.	302	3.61	1.00
Exposures to chemical fertilizers can increase impaired sight.	302	3.22	1.08
Grand Mean		3.60	

Source: Own Survey, 2019

According to NAPE [9], the work division/position is the major factor which determines the health of flower farm workers. A study done by Tigist [21] also showed that, all the working conditions that had directly related to flower production tasks affects workers health, but workers engaged in the greenhouse and chemical mixing and spraying sections were more affected.

Table 3. Workers’ perception difference of health impacts of chemicals due to sex

Health impacts of chemical exposures	Sex	N	Mean	Standard deviation	Std. error mean
Exposures to fertilizers and pesticides cause vomiting.	Male	80	3.94	0.80	0.09
	Female	222	3.76	0.97	0.07
Exposures to pesticides cause sneezing and shortness of breath.	Male	80	4.29	0.70	0.08
	Female	222	3.83	1.06	0.07
Exposures to pesticides and fungicides cause skin rash.	Male	80	4.18	0.73	0.08
	Female	222	3.76	0.98	0.07
Exposures to pesticides cause appetite loss.	Male	80	4.14	0.90	0.10
	Female	222	3.48	1.12	0.08
Exposures to chemical fertilizers and pesticides cause headache.	Male	80	4.11	0.80	0.09
	Female	222	3.70	1.07	0.07
Exposure to fertilizers and pesticides cause stomach cancer.	Male	80	3.65	0.94	0.11
	Female	222	3.15	0.98	0.07
Exposure to pesticides can cause birth defects and reproductive system damage.	Male	80	4.15	0.93	0.10
	Female	222	3.07	1.24	0.08
Exposures to pesticides can damage the nervous system.	Male	80	3.61	0.96	0.13
	Female	222	3.29	0.93	0.07
Exposures to chemical fertilizers and pesticides cause dizziness.	Male	80	4.08	0.94	0.11
	Female	222	3.45	0.98	0.07
Exposures to chemical fertilizers can increase impaired sight.	Male	80	3.45	1.04	0.12
	Female	222	3.14	1.09	0.07

Source: Own Survey, 2019

Table 4. Workers’ perception difference of health impacts of chemicals due to sex

Health impacts of chemical exposures	Assumption	t	Sig.(2-tailed)	Mean diff.	Std. error diff.
Exposures to fertilizers and pesticides cause vomiting.	Equal variances	1.490	0.137	0.181	0.121
Exposures to pesticides cause sneezing and shortness of breath.	Equal variances	3.603	0.000	0.459	0.127
Exposures to pesticides and fungicides cause skin rash.	Equal variances	3.449	0.001	0.414	0.120
Exposures to pesticides cause appetite loss.	Equal variances	4.748	0.000	0.660	0.139
Exposures to chemical fertilizers and pesticides cause headache.	Equal variances	3.152	0.002	0.414	0.131
Exposures to fertilizers and pesticides cause stomach cancer.	Equal variances	3.949	0.000	0.501	0.127
Exposures to pesticides cause birth defects and reproductive system damage.	Equal variances	7.134	0.000	1.082	0.152
Exposures to pesticides can damage the nervous system.	Equal variances	3.350	0.001	0.395	0.118
Exposures to chemical fertilizers and pesticides cause dizziness.	Equal variances	4.736	0.000	0.600	0.127
Exposures to chemical fertilizers can increase impaired sight.	Equal variances	2.215	0.028	0.310	0.140

Source: Own Survey, 2019

Table 5. Workers’ perception difference between production and protection labour divisions

Health impacts of chemical exposures	Assumption	t	Sig. (2-tailed)	Mean diff.	Std. error diff.
Exposures to fertilizers and pesticides cause vomiting.	Equal variance	-.725	.469	-.139	.191
Exposures to pesticides cause sneezing and shortness of breath.	Equal variance	-2.045	.042	-.448	.219
Exposures to pesticides and fungicides cause skin rash.	Equal variance	-2.007	.046	-.394	.196
Exposures to pesticides cause appetite loss.	Equal variance	-4.302	.000	-.988	.230
Exposures to chemical fertilizers and pesticides cause headache.	Equal variance	-1.636	.104	-.374	.229
Exposures to fertilizers and pesticides cause stomach cancer.	Equal variance	-2.675	.008	-.602	.225
Exposures to pesticides cause birth defects and reproductive system damage.	Equal variance	-3.913	.000	-1.013	.259
Exposures to pesticides can damage the nervous system.	Equal variance	-2.491	.014	-.446	.179
Exposures to chemical fertilizers and pesticides cause dizziness.	Equal variance	-5.305	.000	-1.066	.201
Exposures to chemical fertilizers can increase impaired sight.	Equal variance	-2.668	.008	-.612	.229

Source: Own Survey, 2019

Table 6. Workers’ perception difference between pack house and protection labour divisions

Health impacts of chemical exposures	Assumption	t	Sig. (2-tailed)	Mean diff.	Std. error diff.
Exposures to fertilizers and pesticides cause vomiting.	Equal variance	-1.118	.266	-.219	.196
Exposures to pesticides cause sneezing and shortness of breath.	Equal variance	-1.321	.189	-.248	.187
Exposures to pesticides and fungicides cause skin rash.	Equal variance	-2.870	.005	-.562	.196
Exposures to pesticides cause appetite loss.	Equal variance	-3.300	.001	-.675	.204
Exposures to chemical fertilizers and pesticides cause headache.	Equal variance	-3.623	.000	-.685	.189
Exposures to fertilizers and pesticides cause stomach cancer.	Equal variance	-3.692	.000	-.580	.157
Exposures to pesticides cause birth defects and reproductive system damage.	Equal variance	-3.208	.002	-.776	.242
Exposures to pesticides can damage the nervous system.	Equal variance	-5.593	.000	-1.039	.186
Exposures to chemical fertilizers and pesticides cause dizziness.	Equal variance	-3.751	.000	-.719	.192
Exposures to chemical fertilizers can increase impaired sight.	Equal variance	-3.635	.000	-.768	.211

Source: Own Survey, 2019

As indicated in the Table 6, except item #1 and #2, the majority of the computed significance (2-tailed) p-value was less than 0.05. Hence, there were significant perception differences between pack house and protection section workers towards the health impacts of chemical

exposures. Flower farms gave a special care for protection section workers since they operate their duties (like chemical mixing and spraying) directly connected to chemicals. Thus, workers perception differences were occurred due to flower farms attention differences among working

sections in protecting from the effects of chemicals.

4. CONCLUSION

A considerable amount of chemical fertilizers and pesticides were applied in flower farms during flower production activities and workers are exposed to these chemicals at different stages of flower growth and these exposures have adverse effects on their health. It was evidenced that exposures to chemicals could cause different health problems to flower farms workers. Therefore, this study has attempted to link flower farms practices with flower farms workers' perceptions. The key findings of this study was that there are significant perception differences among workers' sex and labour divisions towards the health impacts of chemical exposures, such as skin rash, appetite loss, stomach cancer, birth defects, reproductive system damage, dizziness, and impaired sight. This perception difference in flower farms was existed among workers' sex and work categories since flower farms had gave much attentions to male protection section workers regarding chemical exposures. Therefore, in flower farms, it is possible to conclude that workers perception differences occurred due to attention differences among workers sex and work categories. That means, majority of workers were not adequately protected from the effects of chemicals. In addition, flower farms were properly implemented health protection mitigation measures through providing the necessary safety tools for small number of protection section workers, but they had given poor attention for the majority of workers. In flower farms, therefore, it is possible to conclude that there are gaps in the proper implementation of ESIA measures and other requirements set in the Bronze level of code of practices towards the protection of workers health and implementations of vital safety measures. Thus, the regional EFWPDA should form a strong link to create consistent, strengthened follow up and support system in flower farms to ensure ESIA studies are implemented effectively. Finally, the scope of this study is limited and we suggest broadening the scope, adding variables and instruments of data collection for further studies.

CONSENT

As per international standard informed written participant consent has been collected and preserved by the authors.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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