



Research Journal of Pharmaceutical, Biological and Chemical Sciences

Risk Evaluation from Work and Pesticide Residues in Farmers' Vegetables and Fruits that Grow in Sananrak Municipality Community, BuengSanan Sub-District, Thanyaburi District, Pathumtani Province, Thailand.

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ABSTRACT

The study aimed to elevate the behavior levels of risk in health and to study pesticide contamination in vegetables and fruits that were grown by community farmers and sell in community markets. The qualitative research approach was utilized for the current pertaining for which both questionnaire and in-depth interview was employed to collect data for the study. The results of the study revealed the majority of the farmers have farming experience of 6-10 years in cultivation of vegetable or fruit crops and have been using pesticide for crops since last 9 years including using pesticides especially in fruit farms. The frequency of applying the pesticides was obtained to be twice a month. Mostly, the pesticides used were Furadan (Carbamate chemical group) and Methamidophos (Organophosphate chemical group). However, smoking while applying the pesticide is a risk behavior and found that most farmers occasionally read labels on pesticides before using, once in a while wearing rubber gloves for chemical protection. Most of them, neither take bath immediately, nor wash the skin that have been exposed to pesticides. The behavior of washing hands immediately before the break for drinking some water or eating some food, to wash some fruits, taking bath after spraying the chemical, changing of clothes that stained on the garments were followed very rarely by the farmers of the study area. Moreover, abnormal symptoms lead to quite high behavior levels of risk in health from work. Accumulation of pesticide residues in vegetables and fruits is determined by using the MJPK pesticide test kit. Vegetables samples of farmers are such as cucumber, Chinese kale, sweet basil and Chinese cabbage were not contaminated significantly and whereas in vegetables of community market have unsafe levels. However, fruit samples of farmers and community market are such as, lime, papaya and guava, were found that accumulated unsafe level.

Keywords: Pesticide Exposure, Risk Evaluation, Pesticide Residues, Vegetables and Fruits

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INTRODUCTION

Food and Agriculture Organization of the United Nation (FAO) reported that Thailand is the 48th country in the world that has enormous land areas for agriculture on the other hand holding worlds 5th position in using pesticides and the 4th of the world by using herbicide including randomly check on vegetables in the fresh-food markets by the Ministry of Agriculture and Cooperatives. The alert information from the pesticide network or Thai-Pan Pesticide Alert Network has randomly collected 16 kinds of vegetable and fruit samples namely red chili, sweet basil, yard long bean, Chinese kale, morning glory, Chinese cabbage, cabbage, cucumber, small eggplant, tomato, Sai Nam Phoeng tangerine, papaya, water melon, cantaloupe, guava and dragon fruit in the total of 136 samples from various distributors during the month of August 2016 from both modern shopping malls and the regular wholesale markets, found 68 kinds of chemical residues. 70.2% of the most exceeding standard chemical residues found in vegetables and fruits from modern shopping malls, 54.2% from the market distributors in which Chinese kale is finding the most exceeding the standard value of chemical residues that has 31 kinds of chemical residues, follow by red chili, while cabbage and Chinese cabbage are found the less chemical residues. However, for fruits, found that Sai Nam Phoeng tangerine is having the most of the chemical residues for 35 kinds [1].

Extensive use of these chemical residues have not only effect farmer's health or consumers, but it will also affect the mammalian food chain. Such as Sri Lanka found that chemical residues in feeding with crop residues, grasses and water to cattle which were contaminated with pesticides encountered high risk to contain pesticide residues in milk [2].

Finally, these chemical residues will accumulate inside consumers' body that consumed the products that has pesticide residues, but how it's going to effect to the body, it depends on the kind of exposure and the amount of those poisonous chemical residues, the symptoms will depend on how severe the chemicals are accumulated in farmers body [3]. Thus, basis in analysis of the risk of pesticide residues in the body that the most of the blood cholinesterase test were screened for high behavior risk of chemical exposure [4].

Pathumtani province is the rural agricultural town that has abundant water resources that suitable for agriculture and it is also closer to the markets. Yet, the province has the whole area for agriculture around 500,000 rai. Mostly 350,000 rai are doing paddy farming, followed by vegetables and fruits. Especially, the Bueng Nam Rak Sub-District, Thanyaburi District, Pathumtani province is very well known Sub-District that farmers grow a wide variety of vegetables and fruits to sell. The study found that most farmers use pesticide in agricultures, for example, Abamectin and Furadan to eliminate insects by using with tangerine, lime, guava and paddy fields. Which are risk safety behavior levels.

Furthermore, farmers use Methamidophos in papaya farms and the most popular of herbicide used are Glyphosate and Paraquat (Metrozone, Gramoxone)[5]. Still, from the preliminary study, found that the Bueng Sanan Sub-District which is located in the Sananrak Municipality which has vegetables and fruits agricultural farming for distribution, especially grew for own consumption and sell for nearby neighborhoods. Therefore, with the aforementioned reasons, it makes researcher interested to study about the behavior risks that may happen from farmers' work when exposure to pesticide and to check up chemical residues that remain in vegetables and fruits.

Research Objectives

- To study the farmer exposure behavior with pesticide.
- To find risk safety behavior levels of farmers while working in farm.
- To study pesticide residues in vegetables and fruits that were grown by community farmers and sold by community market.

Research Procedures

This study is the qualitative research which collected data by using the risk evaluation form of farmers' work and the exposure to pesticide. The form adopted from the Bureau of Occupational and Environmental Diseases from the Department of Disease Control, Ministry of Public Health and collected the

data from 10 selected farmers who grow vegetables and fruits. Thus, scores calculation and the outcome interpretation from the questionnaire form are divided into 2 characteristics.

•**1st Characteristic.** From Item 1 – 6 are the questions about risk behavior or unsafe behavior.

-**No**, means has performed very little in that risk behavior or never perform, it is considered as low risk and will get 1 score for that.

-**Occasionally Yes**, means occasionally perform that risk behavior which counts as moderate risk, will get 2 scores.

-**Yes, for every time**, means has performed risk behavior every time or most of the time which consider as high risk on that Item, will get 3 scores.

•**2nd Characteristic.** From Item 7 – 14 are questions about safety behavior in reducing risk or to prevent danger from the pesticide exposure.

No, means has very little or never perform that behavior which consider as high risk on that Item, will get 3 scores.

Occasionally Yes, means sometimes has performed the safety behavior on that Item which consider as moderate risk, will get 2 scores.

Yes, for Every time, means has performed that safety behavior regularly every time or most of the time which consider as low risk in that Item, will get 1 score. All details are tabulated and represented in Table No. 1.

Table No. 1. Illustrates farmers' Behavior in Chemical Exposure

Farmers' Behavior in Chemical Exposure	Expressed Risk Behavior		
	No	Yes Occasionally	Yes Every Time
1. Do you use insecticide in spraying or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Do you use herbicide in spraying or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Do you use leak tank in spraying or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Do you smoke/pipe tobacco smoking or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Do you eat food/drink water around the working area or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Do you drink liquor/beer/alcohol at the working area or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Do you read labels of the new chemical bottle before using or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Do you wear rubber chemical protection gloves when you are working with chemical or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Do you wear boots or covering up shoes to protect chemical or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Do you take bath every time when your clothes are soaked with chemical or wash your skin that exposed with the chemical immediately or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Do you wash your hand before drinking water or eating your food or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Do you wash vegetables and fruits every time before eating or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Do you immediately change clothes that have chemical stain after finishing spraying or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Do you immediately take bath and clean up yourself after spraying or not?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sum up the two characteristics scores in order to distinguish the risk of using or exposure to the pesticide and then bring the score results to find out for the symptoms severity column from the risk scores of sickness or the unusual symptom data that happened after using or exposure with the chemical according to Table No. 2[6].

Table No. 2 Health Risk Levels in Preliminary Work

Sickness Symptom After expose with Herbicide	Risk Level Scores of Using or exposure with Herbicide Chemical		
	14-20 Scores	21-28 Scores	29-42 Scores
No Symptom	Low Risk	Moderate Risk	Risk is quite high
With one level of little symptom	Moderate Risk	Risk is quite high	High Risk
Have one moderate level of symptom onward	Risk is quite high	High Risk	High Risk
Have one severe level onward	High Risk	High Risk	Very High Risk

Then, assessed the accumulation of the pesticide contaminated with the chemical groups of Organophosphate and the Carbamate in vegetables and fruits by the MJPK pesticide test kit which is the basic test kit to determine pesticide residues and is the tool kit for the Enzymes Cholinesterase restrain group in vegetables and fruits developed by Department of Medical Sciences [7].

Population and targeted group are the 10 selected farmers that grow vegetables and fruits in the study area of the Sananrak Municipality. Data was collected according to the questionnaire and focus group conversations, process data (information) and check up evaluation by facts record that obtained from the focus group related to the using of pesticide and accumulation of chemical residues in vegetables and fruits that farmers grew. Compared with the community market by checking up the sampling group, such as cucumber, Chinese kale, sweet basil, Chinese cabbage, lime, papaya and guava (farmers' favorite plants) that farmers grow for sale and consumption.

RESULTS AND DISCUSSION

Researcher collected data from 10 farmers that grow vegetables and fruits in the agricultural community of the Sananrak Municipality, found that most farmers are 60% men and 40% are women, aged between 50-59 years old with primary education level. 80% of the farmers prefer to grow fruits, such as lime, papaya, guava with the average land size of 3 – 5 rai, followed by the average of 20% of vegetables grow, such as cucumber, Chinese kale, sweet basil, Chinese cabbage on the average land size of 1 rai. The study indicates that average experience of the farmers was 8 years. The Majority of the farmers was farming experience of 6-10 years, and have been using pesticide in the last 9 years which is equivalent to 80%, yet, including the using of pesticide for fruits. Thus, during the past month had already used chemical for 1 time, but the frequency of using chemical will be 2 times per month and the duration of chemical spray will be up to the sizes of land.

The chemicals spraying applied by the tugboat because of the furrowing areas. Furadan used to eliminate foe plants which consists Carbamate chemical group and Methamidophos (Organophosphate group). It found that 20% of the farmers do not use pesticide in growing vegetables and also found that farmers that use pesticide with crops are spraying the chemical by themselves.

From the above generic data study, researcher evaluated risk behavior that happened to the 8 farmers that grow fruits and used pesticide, found that 75% of the farmers are smoking while performing the farming activities, 25% is non-smokers and 25% drinking liquor while spraying the pesticides (table No. 3.)

Table No. 3. Fruit Farmers' Unsafe Risk Behavior Characteristic

Unsafe Risk Behavior of Characteristic	Total People (Percentage of Risk)		
	Not Using	Use Occasionally	Use Every Time
Have insecticide chemical spray.	0	0	8(100)
Have herbicide chemical spray	0	0	8(100)
Have leaking chemical tank in spraying	8(100)	0	0
Smoking/pipe tobacco while working	2(25)	6(75)	0
Eating food/drinking water at the working areas.	8(100)	0	0
Drinking liquor/beer/alcohol drinks at the working areas.	6(75)	2(25)	0

Table 3 demonstrates that the fruit farmers' unsafe risk behavior involved in the farming activities to reduce risk and to prevent risk from the using of pesticide. The study data indicates that, every farmer occasionally read the chemical labels before using and 25% of the farmers are wearing rubber gloves to prevent the exposure to pesticides every time. 37.5% of the farmers are neither wearing gloves occasionally nor using. However, 25% of the farmer's wears covering up shoes to protect from chemical hazard. 12.5% of the farming community occasionally wearing covering up shoes. Majority of the farmers (62.5%) of the study area not wearing shoes at all, which is worrying factor. However, during break time for food and drinks, found that 62.5% of most farmers are washing hands before break and 37.5% is not washing hands at all. For vegetables and fruits wash before eating aspect, found that farmers wash fruits every time and 37.5% of the farmers wash occasionally and 25% of the farming community are not washing fruits at all. 62.5% of farmers occasionally change clothes after the application of pesticides and take shower immediately. 37.5% of the selected farmers never take bath and change the clothes after spraying the pesticide (Table No. 4.).

Table No. 4. Safety Behavior that reduce risk or danger prevention from the using or exposure to pesticide.

Safety Behavior Characteristic from Chemical exposure	Numbers of People and Risk Percentage		
	No Behaving	Occasionally Behaving	Every Time Behaving
Read the new chemical labels before use	0	8(100)	0
Wearing rubber gloves while working with chemical for chemical prevention	3(37.5)	3(37.5)	2(25)
Wearing booths or covering up shoes for chemical prevention	5(62.5)	1(12.5)	2(25)
Immediately taking bath or wash the skins that exposure with chemical every time when clothes are soaked with chemical	8(100)	0	0
Wash hands every time before break for water or eat food	3(37.5)	5(62.5)	0
Wash vegetables and fruits every time before eating	2(25)	3(37.5)	3(37.5)
After spraying chemical, immediately change clothes that stained with chemical	3(37.5)	5(62.5)	0
Immediately taking a bath and clean up the body after finishing spraying chemical	3(37.5)	5(62.5)	0

Table 4 demonstrates that the safety behavior that reduce risk or danger prevention from the using or exposure to pesticide. The study results revealed that 62.5% of symptoms are weak and tired, cough, spinning head, headache, skin rash, heart palpitation, unable to sleep, burning nose, sore and dry throat and sweating which are counted as minor symptoms, follow by the moderate symptoms of 12.5%, such as eyelid twitching, nausea and vomiting, myasthenia gravis, cramp and shaking hand. 25% of the farming community shows the normal health and have not reported any of the above said abnormal symptoms.

However, overall behavioral scores were taken account to find the health risk level. From the study results it was found that 62.5%, of the farmers have quite high risk in health followed by 25% of the moderate risk and the high risk to health which is equivalent to 12.5%. [8] Besides, found that 62.5% of most farmers have gone for Enzyme Cholinesterase in blood level check from public health officers of the District Health Promotion Hospital and the results are at risk. There is 37.5% that has never been to check up at all. Results from the mentioned checked up, farmers are still having same old habits of using the chemical because they think that there has no serious effect to health and that they can buy medicines from drugstores as according to the symptoms. In case if there is an unusual symptom after using or exposure with the chemical, farmers will take rest and hire someone else to do the spraying job for them.

While assessing the accumulation of the pesticide residues in vegetables and fruits with the MJKP pesticide Test Kit, vegetables that farmers grow and compare with the ones that sell in the community market stalls, found that vegetables sampling group, such as cucumber, Chinese kale, sweet basil and Chinese cabbage, were picked up 3 kinds of vegetables each from the 3 different market stalls. Results were found that all kinds of vegetables of each market stall have the color changing into orange-pink and when compare the color with the control tube, all samples of vegetable color have been turned to dark-orange color. The results of the study revealed and evidenced that unsafe levels of pesticide residues are found in vegetables that sell along the community market. On the contrary, with the same kind of vegetables that farmers grow, found that the color inside the test tube have been not changed and when compare with their respective control tube, they also have dark-orange color. It shows that no pesticide residues in the vegetables that grew by farmers.

Pesticide residues checking in fruits, found that both fruits were collected from community market and from the farmers, such as lime, papaya and guava, found that the color from the test tube has been changed the color to orange-pink, and when compare with the control tube, the color has turned to orange-dark, it shows that pesticide is found in both the samples collected from community markets and the farmers' farms.

CONCLUSION

Most farmers grow fruits, such as lime, papaya and guava in the study area. The average land for farming is (Thai-PAN, 2017) between 3 -5 rai followed by 1 rai for the growing of vegetables, namely cucumber, Chinese kale, sweet basil and Chinese cabbage. Since, 9 years all farmers have been using pesticide for fruit crops. Thus, the frequency of using chemical is two times for a month and the duration of spray depends on the size of cultivated land. For chemical spray, farmer will spray chemical by himself by using tugboat due to furrowed areas. Mostly pesticides used in the study locations are Furadan (Carbamate chemical group) and Mathamidophos (Organophosphate chemical group). However, when evaluates the value of risk level towards health from the using and exposure to chemicals, it was found that most of the farmers are in quite high risk to health.

Assessment of pesticide residue accumulation was carried out in vegetable samples from farmers and community markets. All kinds of vegetables that bought from retailers for resale in Pathumtani province market, such as cucumber, Chinese kale, sweet basil, Chinese cabbage have unsafe levels of pesticide residues. On the contrary, vegetables that grow by farmers have no pesticide residues. Besides, also found that fruits from the community market that bought from the big markets in Pathumtani province for resale and from the farmers' own farms, such as lime, papaya and guava, both have the unsafe level of pesticide residues.

RECOMMENDATIONS

This study was conducted with the cooperation of Sananrak Municipality as part of academic development. The Sananrak Municipality arranged promotional programs by sending public health officers to educate and disseminate knowledge to farmers about pesticides accumulation in vegetables.

Based on the identified problems in the study area, a few recommendations can be suggested. Need to conduct awareness campaigns among farmers and it should be initiated by the Government of Thailand to develop best practices for cultivation the of vegetables and fruit production.

Public health officers need to visit the fields frequently to advice the people about the proper behavior while applying the pesticide to crops.

Need to take initiative steps to advise the farmers to reduce or to avoid the using of chemical and educate the people about proper washing fruits before eating.

Results of the study have recommended that the diligence should be paid to address problems and to overcome the above said constraints. Needy support should be initiated on good practices for fruits and vegetable cultivation. In this particular direction research institutions of Thailand should play a major role.

Eventually, the study has revealed that the stakeholders should take some immense endeavors to strengthen the agricultural practices, for the sustainability of agricultural production.

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