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Household pesticide use in agricultural community, Northeastern Thailand

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ABSTRACT

Thailand is known as an agricultural country and the world's agricultural products exporter. Several pesticides are commonly used in both farm and household. The main objective of this study was to determine household pesticides use and frequency of use among people living in agricultural community, northeastern, Thailand. Face to face questionnaire was completed throughout 108 households' member. The results showed that the participant age ranged from 19 to 84 years. The average age was 53.0 (±12.3) years and 80.6% of respondents graduated from primary school. Of 73.1 % participants reported that they have been commonly using pesticide in their household mainly contains pyrethroids ingredient. It showed that the association between educational background of the participants versus type of household pesticides application and frequency of household pesticide usage were significantly low and negative correlation, but pests in home were significantly moderate and positive correlation. This study described the intensity of household pesticide use in families living in agricultural community; it might be assumed of their indirect exposure regarding behavior when using household pesticide.

Keywords: Household Pesticide, Agricultural Community, Pesticide application, Indirect Pesticides Exposure.

INTRODUCTION

Thailand is known as an agriculture country with more than 54.2% of the total area being used for agricultural production. The 54.4% of agriculture areas reported using pesticides, of which 45.9% used chemical. The majority of agriculture areas using pesticides were in the Central and Northeastern Region (76.5 and 44.9% respectively) (Agricultural Census, 2003). Ubonrachathani province, located in the northeastern, is a main land for growing chili product of the country (Siriwong *et al*., 2010). The common pesticide used in this farm area is organophosphate pesticides (OPs) such as chlorpyrifos and profenofos (Norkaew *et al*., 2010; Taneepanichskul *et al*., 2010). The OPs belong to a wide group of chemicals of growing public health concern including leukemia, non- Hodgkin's lymphoma, cancers, and respiratory symptoms (Meinert *et al*., 2000; Richter and Chlamtac, 2002; Salameh *et al*., 2003). Specific sign and symptom of OPs are associated with delayed neuropathy, chromosome aberrations, central nervous system alterations and NHL (Maroni and Fait, 1993).

In the agricultural area, several pesticide compounds have been found to contaminate indoor environment, as a consequence of indoor as well as outdoor uses, for occupational and residential purposes (Lewis *et al*., 2001). Residential people might be exposed at home to various pesticides, such as organochlorines,

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organophosphates and pyrethroids (Bouvier *et al*., 2006). Children and spouses of farmers are potentially exposed to pesticides indirectly by take-home contamination; pesticides can be tracked into farm homes on the clothing and shoes of farmers (Curwin *et al*., 2002).

Parental occupation involving pesticide application has been associated with childhood cancers (Daniels *et al*., 1997; Zahm and Ward, 1998; Flower *et al*., 2004) and household pesticide use has been associated with childhood leukemia (Ma *et al*., 2002). Children living with parents who work with agricultural pesticides, or who live in close to pesticide-treated farmland, have higher exposures than do other children living in the same community (Fenske *et al*., 2002; Lu *et al*., 2000) and children living in agricultural areas may be exposed to higher levels of pesticides than other children because of pesticides tracked into their homes by household members, by pesticide drift or by playing in nearby fields (Eskenazi *et al*., 1999).

In farm homes, families may be exposed to pesticides through home contamination even though they may not participate in farming activities involving pesticide use. Residential environments in proximity to farm operations in which pesticides are used and may contaminate throughout several routes including airborne spread, tracking of contaminated soil into the home and through deposition on the clothing of applicators.

Indirect inhalation and dermal exposure of families to pesticides may occur through redistribution of pesticides via indoor air to surfaces. Families may be exposed to pesticides through food and/or drinking water and in homes that pesticides have been sprayed. The potential for exposure people who are living in agricultural community to pesticides is to date considerable and raising concerns as an indirect exposure of susceptible group. The objective of this study was to determine household pesticides use and frequency of use among people living in agricultural community.

MATERIALS AND METHOD

This study was a cross-sectional study for household pesticide use in agricultural community in Ubonratchathani province, northeastern, Thailand. The study population was focused on people living in agricultural community including 108 households. All participants signed the consent form, approved by The Ethic Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University (COA No. 054/2555) before data collection.

The factors considered were indoor pesticides used, house cleaning period and time, and cleaning ways. The questionnaire consisted of (1) the socio-demographic characteristics for each participant including family income and occupation (2) general information of house and living space such as house area, room/space that family often spend time during day, indoor pesticides used, type of household pesticides applications, frequency of usage (time/week), latest household pesticide use, house cleaning period and ways. Data were collected throughout face to face technique with 15-20 minutes interviewing in April, 2012.

RESULTS

Table 1 demonstrates the general profile and socio-demographic characteristics of sampling population. Table 1 showed the participant age ranged from 19 to 84 years. The average age (±SD) was 53.0(±12.3) years. The majority of the respondents were in the range of 41 to 50 (27.6%) and 61 to70 years (27.0%), while of 24.1% were in range of 51 to60 years and of13.9% were in range of 31 to 40 years, and 5.5% of remaining were older than 70 years.

The majority of the participants were female (52.8%) and 47.2% were male, 80.6% of respondents graduated from primary school and 18.5%of them graduated from secondary school. About half of respondents (52.7%) had an income less than 5,000 baht per month, of 33.4%had an income 5,001-10,000 baht per month, and 13.8%had an income more than 10,000 baht per month. Approximately, 49.1% of the respondents were employees, of 24.1% were farmers, of 13.0% were local business owners such as local food shop or grocery shop, and 11.1% of them were unemployed.

For household pesticide use (Table 2), 73.1% of the participants reported using household pesticides. Most of them (70.9%) used pesticides bottled sprays, some of them (26.6%) used mosquito coils, and few of them (2.5%) used insecticides chalk (also known as miraculous chalk) for pest control in their house such as ants and small insect. Mosquitoes were the most pests reported (63.3%), followed by cockroaches (22.8%) and ants (13.9%). About 82.3% of the household pesticide users reported using pesticide 1-2 times per week, 15.2% of them used 3-4 times per week. Most of them (36.7%) used pesticide latest during1-2 weeks ago, 29.1% of the users used the latest during 3-4 weeks ago, 25.3% of them used the latest within a week and few of them (8.9%) used the latest over 4 weeks. Of 66.7% the respondents reported that after each pesticides spraying mostly in the daytime, they stayed for their house activities outside house around their common area during the day, but 28.7% of them stayed in their bed room and 4.6% stayed inside common area.

About the frequency of house's cleaning, it was found that in that 45.4% of the respondents generally cleaned their house 1-2 times per week, 44.4% of them cleaned 3-4 times per week, and 10.2% of them cleaned over 5 times per week. Most of participants (53.7%) reported the cleaning ways that they (36.1%) sweep their house floor

Table 1. Socio-demographic characteristics of the respondents (n=108)

Characteristics	n	%
Gender		
Male	51	47.2
Female	57	52.8
Age		
<30	2	1.9
31-40	15	13.9
41-50	30	27.6
51-60	26	24.1
61-70	29	27
71-80	4	3.7
>80	2	1.8
Mean± SD = 53.0± 12.3 Range = 19 to 84		
Education		
Never	1	0.9
Primary school	87	80.6
Secondary school	20	18.5
Income (Baht/month)		
< 5,000	57	52.7
5,001-10,000	36	33.4
10,001-15,000	15	13.8
Occupation		
Unemployed	12	11.1
Local business	14	13.0
Employee	53	49.1
Farmer	26	24.1
Others	3	2.8

Table 2. Household pesticides and their application (n=108)

Information	n	%
Household pesticide uses		
Yes	79	73.1
No	29	26.9
Pests in home		
Mosquitoes	50	63.3
Cockroaches	18	22.813.9
Ants	11	
Type of household pesticides application		
Spray	56	70.9
Coil	21	26.6
Others	2	2.5
Frequency of household pesticide usage (time/week)		
1-2	65	82.3
3-4	12	15.2
>5	2	2.5
Latest household pesticides use		
<1 week	20	25.3
1–2 weeks	29	36.7
3-4 weeks	23	29.1
>4 weeks	7	8.9

Table 2. Continue

Family area during pesticides application during day		
Bed room	31	28.7
In house common area	5	4.6
Outside common area	72	66.7

and follow by wet mop. And 6.5% of them combined wet mop with detergent but the remaining (3.7%) used only dry mop.

Among the 79 respondents, all household pesticide products in this area contain pyrethroids, for example in sprays; the active ingredients are esbiothrin, d-tetramethrin, cypermethrin, prallethrin, imiprothrin and permethrin. Mosquito coils were also commonly used and the active ingredients are esbiothrin and d-allethrin, in the meanwhile, insecticide chalk was not much used as sprays and coils in which the active ingredient was deltamethrin. However, trademarks of those products were confidentially protected information. (Table 3)

In Figure 1 shows type of household pesticide used applications that respondents usually used in study area and categorize by product brands. The spray brand 1 ingredients are esbiothrin, imiprothrin, and permethrin, the spray brand 2 contains cypermethrin, prallethrin, and imiprothrin, and the sprays brand 3 contains d-tetramethrin, cypermethrin, and permethrin. Most respondents reported that about 26.6% of respondents used the spray brand 3 (26.6%), 22.8% of the used the spray brand 2, and the remaining 21.5% used the spray brand 1.

For mosquito coil, there are 3 popular products use in this area. The ingredient of mosquito coil brand 1 is esbiothrin, and same ingredient of brand 2 and brand 3 is d-allethrin. Of 13.9% the respondents used mosquito coil brand 3, 10.2% used mosquito coil brand 1, and few of them (2.5%) used mosquito coil brand 2. For insecticide chalk, the respondents reported used only 1 product contains deltamethrin, and only 2.5% of them used it as household pesticides.

The association between education and type of household pesticides application, and frequency of household pesticide usage were represented with Spearman's rank correlation coefficients (Table 4). The association between educational background of the participants versus type of household pesticides application and frequency of household pesticide usage were significantly low and negative correlation (Spearman's rank correlation coefficient -0.211 and -0.241 at $p< 0.05$, respectively).

The association between pests in home and type of household pesticides application, and frequency of household pesticide usage were significantly moderate and positive correlation (Spearman's rank correlation coefficient 0.577, and 0.577 at $p< 0.01$, respectively) as show in table 4. The correlation indicated that when the pest infestation in households, they were use insecticides more often and manage pests as they see fit such as for mosquitoes they commonly use spray and coil, and for ants they use insecticide chalk.

DISCUSSION

In this study, the results showed the age ranged from 19 to 84 years. For local traditional in Thailand, elderly people will be living with their family when retired. Then, the majority of this study was in range of 41-70 years. These findings are similar to other research that demonstrated that 26.0% of the participants were between the ages of 41 to 50 years (Recena *et al*., 2006). The majority of the participants were female (52.8%), 80.6% of respondents graduated from primary school, which was in accordance with a study conducted in Brazil where 83.2% of workers had less than 8 years of education (Recena *et al*., 2006). Also, in another research study undertaken in Nepal, data revealed that most of participants had less than 8 years of education (Atreya, 2007).

This study found that 73.1% of the participants reported using household pesticide which is similar to another study in northern California that showed total of 80% of the participants reported using insecticides in their houses (Wu *et al*., 2011) and in Uganda found that most of the participants used pesticides as household pests control (Nalwangka and Ssempebwa, 2011). In addition, house's hygiene cause health problems and home environment is widely considered to be the most common pesticide-treated indoor environment (WHO, 1997). Household insecticides were used to treat problem insects such as mosquitoes, ants, and cockroaches. These pests have been implicated with causing disease in households, for example malaria and asthmatics (Nalwangka and Ssempebwa, 2011). On the other hand, a study in Minnesota reported that 88% of household with children used pesticides in their house (Adgate *et al*., 2000). For pesticide applications 70.9% used sprays, 26.6% used mosquito coil and 2.5% of them used insecticides chalk for pest control in their house. Insecticides chalk was known used to be effective at killing the specific insect; such as ants. In other hand, the research undertaken in Uganda and northern California were found that the majority of household pests control method are insecticides spray followed by using coils and

Table 3. Active ingredients of household pesticides used in study area

Household Pesticide Type	Active ingredients (%, W/W)							
	Esbiothrin	d-Allethrin	d-Tetramethrin	Deltamethrin	Cypermethrin	Prallethrin	Imiprothrin	Permethrin
Spray Brand1	0.11						0.06	0.06
Spray Brand2					0.1	0.03	0.03	
Spray Brand3			0.11		0.16			0.255
Coil Brand1	0.1							
Coil Brand2		0.225						
Coil Brand3		0.2						
Insecticide chalk Brand1				0.11				

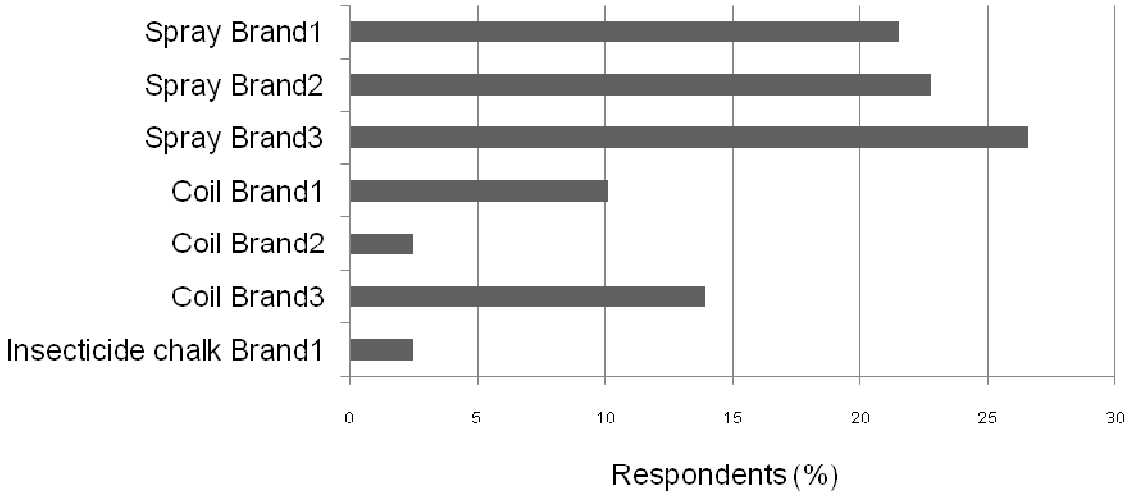

Figure 1. Typical type of pesticides used in household

Table 4. Association among education, pests in home and household pesticide use.

Variables	Spearman's rho
Education and Type of household pesticides application	- 0.211*
Education and Frequency of household pesticide usage	- 0.241*
Pests in home and Type of household pesticides application	0.577**
Pests in home and Frequency of household pesticide usage	0.577**

**. Correlation is significant at the 0.01 level.
*. Correlation is significant at the 0.05 level.

insecticide chalks (Wu *et al*., 2011; Nalwangka and Ssempebwa, 2011).

All household pesticides used in this area contained pyrethroids, for example in sprays; the active ingredients were esbiothrin, d-tetramethrin, cypermethrin, prallethrin, imiprothrin and permethrin. Mosquito coil were also common used and the active ingredients were esbiothrin and d-allethrin. Pyrethroids exhibit neurotoxin effects by modulating sodium channel voltages. In the past several years, the use of synthetic pyrethroids has escalated as the use of the more toxic OP and carbamate insecticides has been curtailed. Many products that are routinely found in retail stores for home use contain pyrethroids (Barr, 2008). In 2011, Nalwangka and Ssempebwa reported that all pesticide sprays used contained pyrethroid such as cypermethrin, permethrin, and pyrethrin formulations (Nalwangka and Ssempebwa, 2011).

CONCLUSIONS AND RECOMMENDATIONS

Household pesticides are commonly used around home environment and most of people appeared more willing to apply pesticides to control indoor pests. They stated that pesticides are more effective and convenient for killing pests at home than other method such as biological control.

Preventive behaviors when using pesticide product is important and concerned regarding to reduce pesticide exposure such as following instructions, washing hands after use, and keeping children and family members away during applying pesticides.

Therefore, evidence- based methods should be developed that can assess the indirect exposure health risk associated with community pesticide use. The intervention tools should be developed for enhancing suitable practice for household pesticide usage and to improve the accuracy in the information given. People in agricultural community should be trained in the proper usage of household pesticide use and knowledge regarding the harmful effects of household pesticides. Therefore educational programs should be organized to increase awareness by holding trainings as well as distributing literature regarding household pesticide use and the hazards of indirect exposure from pesticide usage among people who living in agricultural community.

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