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Herbicides Exposure And Skin Symptoms Among Paddy Farmers In Tanjung Karang, Selangor

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ABSTRACT

Objective: The aim of this study was to determine the relationship between skin exposure and skin symptoms among paddy farmers in Tanjung Karang

Method: Tinopal (CBX-S) was used as fluorescent tracer to trace the pesticide contaminant on the respondents' bodies. There were 2 types of scores that were used to quantify the dermal exposures, namely the Exposure Evaluation Matrix (EEM) and Determinants of Dermal Exposure Ranking Method (DERM).A self-constructed questionnaire was also used to record the socio-demographic background and the skin symptoms of the respondents.

Result: The results showed that therewas no significant association between the dermal score with skin symptoms among the exposed group (p-value>0.05). Thehighest prevalence of body part exposed were right fingers (36.6%) and back of the thorax (35.2%).Itchiness was the most common symptom reported among the respondents (20%), followed by skin redness (10.5%).

Conclusion: There was no significant association between skin symptom and dermal exposure scores among the exposed group. However, statistics showed that rashes had significant relationship with selected variables such as smoking and hourly work duration.

Keywords: *Paddy Farmer, Skin Symptoms, Dermal Exposure, EEM, DERM*

1. Introduction

Herbicide use is the most effective and economic means of weed control, but inappropriate application may not only increase production cost and yield but also may also cause development of herbicide resistant weeds and environmental hazard (Karim et al., 2005). Malaysian Government has spent million dollars to develop

agricultural sector mainly to increase farmers' income, enhance the productivity and provide employments (Fuad et al., 2012)). Through the survey, it is found that herbicides that are commonly used by farmers, include paraquat, 2, 4-dichlorophenoxyacetic acid and glyphosate. Most farmers in Malaysia are currently using herbicides as ineffective tool in controlling weeds in wet direct seeded or transplanted rice (Karim et al., 2005). Currently, the health issues on the use of agrochemicals in Malaysia have caused serious concern. Most of the farmers generally were not aware of pesticide potential hazards, whereby they applied higher than recommended concentrations, did not pay attention to the pesticide labels, did not wear appropriate protective clothing, and did not observe the recommended period between spraying and harvest (Spiewak, 2001).In the district of Tanjung Karang, Selangor where the study was carried out, paddy cultivation has become the main activity in the community. This area was selected because it is the third largest area of paddy farmers in Peninsular Malaysia. It is also known as 'the rice bowl of Selangor. The paddy farms in Kampung SawahSempadan cover an area of approximately 2,300 hectares of Tanjung Karang. The selection was also made because many cases of pesticide poisoning were reported by the paddy farmers in the area (Rozita et al. 2011).

2. Materials and Method.

2.1. Study location

This is a cross-sectional comparative study design was carried out to assess the exposures and effect of herbicide on the skin of the paddy farmers in Tanjung Karang, Selangor.

2.2 Study population

The respondents were made up of 75 paddy farmers who were involved in handling of herbicides in their job tasks, age of 18- 64 years old and have worked for more than 6 months in the paddy field, while the comparative group were30farmers who work in other villages,having the same background as the exposed group.

2.3 Skin visualization

Before the farmer starts his spraying activity, fluorescent tracer (Tinopal-CBX) was placed into the mist blower's tank. Then, the farmer was allowed to apply the pesticide as usual. After finishing their work tasks, the farmers were brought into a dark room provided, and were observed using a UV lamp for illumination without filter (UVP model UVSL-26P; 365 nm long wave). Farmers were given eye protection. The observation procedure inside the dark room was described with reference to a published paper (Aragon et al., 2004).At the same time, the pattern of fluorescent images on the skin of the farmer after application, was videotaped using a digital camera. The recorded fluorescent deposition images on the farmer's body were quantified by using an adapted form of Fenske's visual scoring method on occupational skin exposure (Aragon et al., 2004, Fenske et al. 1993)

2.4 Visual Scoring System

There were two scoring systems used to evaluate the dermal exposure on the respondent which consisted of the Visual Scoring System using Exposure Evaluation Matrix (EEM) (Fenske et al. 1993) and Determinants of Dermal Exposure Ranking Method (DERM) (Blanco et al. 2005).

2.5 Exposure Evaluation Matrix (EEM)

The rows, Exposed Area denoted the degree of extension of the fluorescence on each body part, while the column of the matrix showed the intensity of the fluorescent tracer. Each of these characteristics of exposure was represented on a scale of 5 possible scores. Exposed Area was subdivided by percent: <20% of the body surface exposure receives a score of "1", whereas >80% exposure scored "5". Similarly, the Exposure Intensity Scale represented a range of exposures from low to high.

2.6 Determinants of Dermal Exposure Ranking Method (DERM)

The Determinants of Dermal Exposure Ranking Method (DERM) was developed to assess exposure toplant protection products under conditions of developing countries (Schneider et al., 2000). This method was a combination of checklists and expert rating methods. Determinants were listed in a form, which was used to check their presence and to assess them using a simple algorithm based on two factors, the type of transport process (T value) and the area of body surface exposed (A value). In addition, the types of clothing worn during application were also included as a protection factor (C value). The type of transport process was evaluated following the conceptual model for dermal exposure

proposed by a reference (Semple et al., 2004). According to this model, the contaminant can reach the skin through emission (direct release from a source onto the skin or clothing), deposition (settlement of the contaminant onto the skin or clothing from the air) or transfer (transport from contaminated surfaces). Once the transport process was characterized, a score (1–5) is assigned, assuming that transfer processes lead to low exposure, deposition processes lead to a medium exposure and emission processes lead to high exposure. The area of the body surface expected to be contaminated by a particular determinant was ranked from 1 to 5, representing percentage ranges of the total body surface as follows: 0–20, 21–40, 41–60% and so on.

3. Results

Background information on the exposed and control group were obtained through self-administrated questionnaires in which socio-demography background information was collected, as shown in the Table 4.

Table 1. Socio-demographic characteristics of the respondents

Variable	Mean (SD)	
	Exposed (n=75)	Control (n=30)
Age (Year)	41.36 (12.73)	40.90(11.51)
Monthly income (RM)	1282.53(492.1)	1340.00 (703.73)
Education years	10.20 (2.13)	10.97 (1.07)
Employment duration (years)	16.72(13.70)	13.97 (7.36)
Work duration (hours per day)	4.73(1.27)	4.50 (0.97)

N=103

Prevalence of body part exposed from the anterior and posterior view to pesticide during work activities was determined using fluorescent tracers dye as shown in Figure 1.Most of the body part exposed was the right finger (36.6%), back of the thorax (35.2%), right palm (25.4%) and left finger (25.4%).

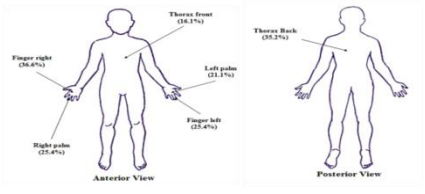

Figure 1. The most exposed body part from the anterior and posterior view

The skin symptoms related to pesticide exposure were included in the questionnaire. Table 4.2 shows the prevalence of self-reported skin symptoms among exposed and control group. The skin symptoms experienced by paddy farmers were itchiness (20%), redness (10.5%), rashes (9%), pain(1.9%), blister(4.0%), crusty (1%) and scaling (1%). The symptoms reported mostly appeared during and after the working with pesticides.

The associations between dermal exposures with skin symptoms among the exposed group were analysed using the Fisher's exact test. In this study, the dermal exposure is quantified using two scoring systems, made up of the Exposure Evaluation Matrix (EEM) and the Determinants of Dermal Exposure Ranking Method (DERM). Overall, there was no significant association between the skin symptoms with the dermal scores such as EEM and DERM among the exposed group (Table.3).

Table 2. Prevalence of skin symptoms among the responents

Skin symptoms	Exposed (n=75) n (%)	Control (n=30) n (%)	Overall (N=103) N (%)	x^2	p
Itchiness	19(25.3)	2(6.7)	21(20.0)	4.667	0.031
Rash	10(13.3)	1(3.3)	11(10.5)	2.285	0.131
Redness	10(13.3)	0	10(9.5)	4.421	0.035
Blister	3(4.0)	0	3(2.9)	1.235	0.266
Scaling	1(1.3)	0	1(1.0)	0.404	0.525
Crusty	1(1.3)	0	1(1.0)	0.404	0.525
Pain	2(2.7)	0	2(1.9)	0.816	0.366

Table 3. The association between dermal exposures with skin symptoms among the exposed group

Variable	EEM score		*p*	DERM SCORE		*p*
	High	Low		High	Low	
Itchiness,						
Yes	4.8 (20.0)	15.2 (80.0)	0.76	5.1 (20.0)	14.9 (80.0)	0.76
No	13.2 (25.5)	41 (74.5)		13.9 (27.3)	41.1 (72.7)	
Rashes						
Yes	2.4 (30.0)	7.6 (70.0)	0.69	2.5 (20.0)	7.5 (80.0)	0.51
No	15.6 (23.1)	49.4 (76.9)		16.5 (26.2)	48.5 (73.8)	
Redness,						
Yes	2.4 (10.0)	7.6 (90.0)	0.43	2.5 (20.0)	7.5 (80.0)	0.51
No	15.6 (26.2)	49.4 (73.8)		16.5 (26.2)	48.5 (73.8)	
Blister						
Yes	(33.3)	2. (66.7)	0.56	0.8 (33.3)	2.2 (66.7)	0.58
No	17.3 (23.6)	54.7 (76.4)		18.2 (25.0)	53.8 (75.0)	

Scaling,						
Yes	0.2(0)	0.8 (100)	0.76	0.3 (100)	0.7 (100)	0.25
No	17.8 (24.3)	56.2 (75.7)		18.7 (24.3)	55.3 (75.7)	
Crusty						
Yes	0.2 (0)	0.8 (100)	0.76	0.3 (100)	0.7 (100)	0.25
No	17.8 (24.3)	56.2 (75.7)		18.7 (24.3)	55.3 (75.7)	
Pain,						
Yes	0.5 (50.0)	1.5 (50.0)	0.42	0.5 (50.0)	1.5 (50.0)	0.44
No	17.5 (23.3)	55.5 (76.7)		18.5 (24.7)	54.5 (75.3)	

Fisher's Exact Test

Multiple Linear Regression statistics was used to determine the selected variables that significantly influence the prevalence of skin symptoms. The skin symptoms, such as itchiness, rashes, redness, blister, scaling, crusty and pain were analysed independently with the predicting factors for the symptoms. Findings showed that, 38% of predicting factors influenced skin rashes. Rashes showed the most significant relationship ($p<0.05$) with the existing predictor f (Table 4.4).

4. Discussion

Discussion

Occupational dermal exposure is one of the significant route of exposure which is always overlooked (9). Lack of appropriate information on the safe handling of pesticides and their awareness on possible acute and chronic health impacts contributed to the participating farmers' pesticide exposure and related illnesses. According to Semple (2004), more attention is needed for dermal exposure to pesticides than the respiratory exposure. The risk of uptake through dermal were shown to be higher and more complicated to control than through respiratory uptake.

Aragoґn et al. (2005), reported that deposition were most frequently observed on the front and back hands of the farmers which (>87%), the front of the left forearm (75%), and the back of the trunk (75%). Depositions were less frequently observed on the front of the right upper arm (19%) and the back of the right thigh (19%).This is similar to this study where high prevalence of pesticide exposure can be observed at the back of trunk (35.2%) and the right hand (36.6%) of the farmers. The pesticide contaminant were observed to be mainly at the back of the trunk due to the spillage of the pesticide from the mist blower which the respondents carried during the spraying activities, while the prevalence of pesticides contaminants on the hand parts were high due to the handling of pesticide without using gloves. Sometimes, theyeven used their hands to stir the pesticides.

Overall, the Visual Scoring System, EEM and DERM showed no significant relationship with any listed skin symptoms. During face-to-face interview, most of the respondent claimed that the effect of skin symptoms rarely happen throughout their work in the paddy field. However, most of them agreed that the skin symptoms such as itchiness, rashes and burning sensation appeared when they used certain type of pesticidesuch as Evisect with its active ingredient such as thiocyclamoxalate. Since there was no significant relationship shown between EEM or DERM score and occupational-related skin symptoms, it showed that, the exposure factor (Table 4.4) might not cause direct and acute effect on occupational-related skin symptoms. However, these factors were still important to consider in order minimize the chronic effect of direct dermal contamination to pesticide. As shown in a study (10), the correct use of PPE was effective in reducing the dermal exposure. Despite the fact that majority of the paddy farmer in this study was aware that herbicides could harm their health, the use of personal protective equipments during pesticide application were not practised in this community. Study by Chester (1993), showed that the effect of pesticide exposure through dermal route might not only cause acute effect, but will resultin skin irritation to a complex systemic illness resulting in death. The farmers might not perceived the immediate effect of skin contamination after pesticide use, but the effect of hydrophobic pesticides might altered dermal penetration for the more hydrophilic herbicides in long-term period(Guo et al., 1996). This is also known that the commercial formulations of herbicides which contain surfactants and other compounds could increase the potential penetration enhancers for mammalian skin (Guo et al., 1996).

5. Conclusion

Overall, therewas no significant relationship between dermal exposure and occupational-related skin symptoms among farmers. However, findings showed that there were high prevalence of dermal contamination of pesticide on the hands, fingers and back of trunk.However, the acute effects of occupational-related skin symptom were not prominent among the paddy farmers. Since dermal contamination to pesticide was reported at this study, further study is recommended to determine the chronic effect of pesticide exposure on the skin at its histological level.

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