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RESEARCH ARTICLE

Impact Of Health Practice Towards Cholinesterase Level Among Organophosphate Pesticides Foggers In Kota Kinabalu

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Abstract

The foggers of the Vector Unit in the Ministry of Health (MOH) are always at risk of being exposed to danger due to the handling of hazardous chemicals which may cause organophosphate poisoning. Study was performed to study the impact of health practice to the cholinesterase level among the foggers and to determine the association between them. Baseline and periodic blood cholinesterase test from a total of 35 foggers from vector unit of Pejabat Kesihatan Kawasan Kota Kinabalu was taken and a set of questionnaires, (KKM/BKP/OHU/08) that was adapted from the Occupational Safety & Environmental Unit, MOH was distributed to the respondents to determine their health practice. The compliance to personal protective equipment (PPE) during the mixing of pesticide and fogging activity showing higher cholinesterase percentage reduction are among foggers who did not used PPE. It shows that those who used PPE are less exposed to organophosphate (OP) pesticide compared to foggers who did not use PPE. Besides that, foggers who takes bath and change clothes after fogging are less exposed than those who do not as higher percentage of cholinesterase reduction are among those not taking their bath. In addition, fogging against the direction of the wind has higher exposure among foggers towards organophosphate compared to those not fogging against the direction as higher percentage of cholinesterase reduction are among foggers who fog against the wind direction. Hence, level of exposure towards organophosphate pesticide among foggers has strong association with the health practices.

Keywords: Foggers, blood, cholinesterase, organophosphate poisoning

INTRODUCTION

The foggers are exposed to pesticides since they are directly involved with organophosphate pesticides usually due to the fogging activities especially when there is occurrence of dengue outbreak. There are 35 foggers working at Vector Unit, Pejabat Kesihatan Kawasan Kota Kinabalu who need to be given appropriate preventive measures and they undergone medical surveillance to protect them from occupational diseases. Malaysia is a developing country and in order to develop local interventions, surveillance on exposure and illness among the pesticide-exposed workers is needed (Weselling et al 1997).

According to Cruz et al (2003), many research work has looked on pesticide residues and its cumulative effect on human beings in the developed countries. Such studies are needed to observe and monitor the exposure of organophosphate pesticides towards foggers locally. Medical surveillance should be conducted from time to time so that the foggers can prevent organophos-phate poisoning and get early treatment before it gets worse.

METHODOLOGY

The study design that was used in this study was a cross-sectional study. The sampling method that was used in this study was purposive sampling. Purposive sampling is utilized as only foggers of vector unit (n=35) of Pejabat Kesihatan Kawasan Kota Kinabalu were taken for this study. Medical Officer, entomologist, and staffs from vector unit who are not involved with fogging activities were not included in this study. All foggers were taken respondents to determine how their practice contributes to their cholinesterase level percentage reduction which shows their level of exposure towards organophosphate pesticide. The respondents were involved in the fogging activities since dengue is endemic at Kota Kinabalu and all the foggers are highly exposed to organophosphate pesticide especially during dengue outbreak. To determine the fogger's level of exposure towards organophosphate and to detect any occurrence of toxication, cholinesterase test was conducted through baseline and periodic blood sampling. Cholinesterase test is known as a primary biomarker in organophosphate exposure and poisoning (Ng et al 2009). Blood sampling was conducted by a trained nurse. Baseline sampling was conducted after 14 days without any exposure to organophosphate pesticide, and periodic sampling was taken in the period of 24 hours of their exposure to fogging activity. An established questionnaire was distributed to the respondents which was adapted from the Occupational Health and Environmental Unit, Ministry of Health

(KKM/BKP/OHU/08) to associate between the health practice of the foggers and their cholinesterase percentage reduction. The data was analysed using SPSS version 20.

$$Cholinesterase\ reduction\ (\%) = [(BL\text{-}PL)/BL] \times 100 \qquad (1)$$

BL = Baseline level, PL = Periodic level

RESULTS AND DISCUSSION

Demographics of respondents

Table 1 shows demographic of the respondents who are involved in this study. All respondents are working adults from age 20 to maximum age for government worker of 60 years old, where 74% of them are below 40 years old. As for gender, male make up for 85.7% of the respondents, while female is 14.3%. 34 out of 35 of the respondents are native Sabahan. Most of them are married (82.9%). As for education level, 11.4% of the respondent has lower secondary qualification (PMR), 40% possessed upper secondary certification (SPM), 22.9% has advanced certification and 25.9% hold a diploma from tertiary education institution. All 35 respondents are from 5 different job designation, where 8 (22.9%) of them are Penolong Pegawai Kesihatan Persekitaran (Assistant Environmental Health Officer), 15 (42.9%) are Pembantu Kesihatan Awam (Public Health Assistant), 8 (22.9%) are Pembantu Awam (PRA), 2 (5.7%) drivers and 2 (5.7%) Pekerja Sambilan Harian (PSH / Part time daily worker).

Table 1 Respondents demographics.

Respondent's Information	n (%)
Age	
20 – 29	11 (31)
30 – 39	15 (43)
> 40	9 (26)
Gender	
Male	30 (85.7)
Female	5 (14.3)
Race	
Malay	1 (2.9)
Native Sabahan	34 (97.1)
Marital Status	
Single	6 (17.1)
Married	29 (82.9)
Education	
PMR	4 (11.4)
SPM	14 (40)
Certificate	8 (22.9)
Diploma	9 (25.7)
Designation	
Penolong Pegawai Kesihatan Persekitaran	8 (22.9)
Pembantu Kesihatan Awam	15(42.9)
PRA	8 (22.9)
Driver	2 (5.7)
PSH	2 (5.7)

Personal Protective Equipment (PPE)

Table 2 below shows the median for cholinesterase percentage reduction for the respondents that used rubber gloves during pesticide mixing are 4.1 (8.58) and those not involved 3.35 (10.38) with the p-value 0.723 which is not significant. The median for cholinesterase percentage reduction for the respondents that used chemical gloves during mixing of pesticide is 0 (1.48) and those not using it is 8.5(4.5) with the p-value 0.006 which is significant. The median for cholinesterase percentage reduction for the respondents that used goggles during mixing of pesticide are 0.34 (5.3) and those not using it is 8.5 (4.5) with the p-value 0.005 which is significant.

The median for cholinesterase percentage reduction for the respondents that used safety shoes during mixing of pesticide are 0.67 (5.3) and those not using it is 9.75 (5.52) with the p-value 0.006 which is significant. The median for cholinesterase percentage reduction for the respondents that used face mask during mixing of pesticide are 1.14 (6.27) and those not using it is 8.5 (5.1) with the p-value 0.031 which is significant. The median for cholinesterase percentage reduction for the respondents that used coverall during mixing of pesticide are 0 (4.95) and those not using it is 8.5 (5.9) with the p-value 0.003 which is significant. Therefore, this shows the usage of chemical gloves, goggles, safety shoes, face mask, coverall during mixing of pesticide has a significant association with the cholinesterase reduction as a higher percentage of cholinesterase percentage reduction are among those not using the personal protective equipment.

Table 2 Relationship of PPE usage during mixing of pesticide with the cholinesterase reduction percentage.

PPE used during chemical mixing	Cholinesterase % reduction Median IQR [a]	Z Statistic	P value [b]
Rubber glove			
Yes	4.1 (8.58)	- 0.355	0.723
No	3.35 (10.38)		
Chemical glove			
Yes	0 (1.48)	- 2.727	0.006
No	8.5 (4.5)		
Goggles			
Yes	0.34 (5.3)	- 2.790	0.005
No	8.5 (4.5)		
Safety shoes			
Yes	0.67 (5.3)	- 2.770	0.006
No	9.75 (5.52)		
Face mask			
Yes	1.14 (6.27)	- 2.157	0.031
No	8.5 (5.1)		
Coverall			
Yes	0 (4.95)	- 2.958	0.003
No	8.5 (5.9)		

[a] skewed to the right; [b] Mann-Whitney test; IQR = Interquartile range

Table 3 below shows relationship of PPE usage during fogging with the cholinesterase reduction percentage. The median for cholinesterase percentage reduction for the respondents that used rubber gloves during fogging is 2.4 (7.55) and those not using 9.5 (15.6) with the p-value 0.029 which is significant. The median for cholinesterase percentage reduction for the respondents that used chemical gloves during fogging is 0 (4.58) and those not using 5.3 (9.35) with the p-value 0.046 which is significant. the median for cholinesterase percentage reduction for the respondents that used goggles during fogging is 0.835 (6.6) and those not using 10.2 (7.6) with the p-value 0.002 which is significant. The median for cholinesterase percentage reduction for the respondents that used safety shoes during fogging is 0.835 (6.27) and those not using 10.2 (6.8) with the p-value 0.003 which is significant. The median for cholinesterase percentage reduction for the respondents that used face mask during fogging is 3.9 (8.5) and those not using 10.65 (33.38) with the p-value 0.034 which is significant.

The median for cholinesterase percentage reduction for the respondents that used coverall during fogging are 0 (6.27) and those not using 8.6 (6.6) with the p-value 0.002 which is significant. Therefore, all the usage of personal protective equipment that is rubber gloves, chemical gloves, goggles, safety shoes, face mask and coverall has a significant association with the cholinesterase reduction as a higher percentage of cholinesterase percentage reduction are among those not using the personal protective equipment.

Both table 2 and table 3 demonstrates that foggers who used PPE during mixing and/or during fogging has less exposure towards organophosphate pesticide compared to those foggers who do not used PPE as higher percentage of cholinesterase percentage decrease are observed among those who don't use PPE. Results in this study is in agreement with the study done by Hoffman et al. (2010) which indicates that the incident of cases and exposure among non-

compliance PPE workers was higher compared to compliance PPE workers.

Table 3 Relationship of PPE usage during fogging with the cholinesterase reduction percentage.

PPE used during fogging	Cholinesterase % reduction Median IQR [a]	Z Statistic	P value [b]
Rubber glove			
Yes	2.4 (7.55)	- 2.190	0.029
No	9.5 (15.6)		
Chemical glove	0 (4.58)	- 1.994	0.046
Yes	5.3 (9.35)		
No			
Goggles			
Yes	0.835 (6.6)	- 3.025	0.002
No	10.2 (7.6)		
Safety shoes			
Yes	0.835 (6.27)	- 2.939	0.003
No	10.2 (6.8)		
Face mask			
Yes	3.9 (8.5)	- 2.117	0.034
No	10.65 (33.38)		
Coverall			
Yes	0 (6.27)	- 3.029	0.002
No	8.6 (6.6)		

[a] skewed to the right; [b] Mann-Whitney test; IQR = Interquartile range

Fogging Direction

Based on Table 4, it shows that foggers who fog against the direction of the wind has higher exposure towards organophosphate pesticide compared to foggers who do not fog against the wind as higher percentage of cholinesterase declination are among those who fog against the wind. Proper training on fogging is essential as the people who work with pesticides should receive proper training in their safe use of chemicals. A study by Levesque et al. (2012) indicates that workers who received training would increase the compliance of wearing PPE and safe practice, subsequently would reduce the harmful effect of pesticide.

Table 4 Relationship of fogging direction with the cholinesterase percentage declination.

Fogging against the wind direction	Yes Median (IQR) [a]	No Median (IQR) [a]	Z Statistic	P Value[b]
Cholinesterase % reduction	8.7 (31.03)	2.4 (8.5)	-1.985	0.047

[a] skewed to the right; [b]Mann-Whitney test; IQR = Interquartile range

Self Cleaning

Table 5 shows that foggers who took their bath and change clothes after fogging has less exposure towards organophosphate pesticide compared to those who did not take their bath and change clothes after fogging as higher cholinesterase percentage reduction is among those who did not take their bath and change clothes after fogging. Improper practices, such as infrequent changing of clothes, inadequate washing, or eating and smoking while wearing contaminated clothing, increase the probability of exposure to pesticides. According to Azmi et al (2006), the exposure of pesticides normally happens during the mixing and loading of the equipment, during the spraying and also occur during improper handling. The workers who use pesticides have only small knowledge or information about the right way to use or even the precautions needed when handling with pesticides. The risk of exposure would increase if they do not practice even the simplest hygienic and protective measures (Maroni et al 2006).

Table 5 Relationship of taking bath and change clothes after fogging with the cholinesterase percentage declination.

Bath & change clothes after fogging activity	Yes Median (IQR) [a]	No Median (IQR) [a]	Z Statistic	P Value[b]
Cholinesterase % reduction	0.84 (5.00)	10.90(3.85)	-4.47	< 0.001

[a] skewed to the right; [b]Mann-Whitney test; IQR = Interquartile range

Giving an education on the importance of self-cleaning after fogging among foggers is essential as stated by Mancini et al. (2009) that education of workers for preventive counter measures is one of the most important measures for reducing the organophosphate's occupational poisoning exposure and poisoning. Although self cleaning such as taking bath and changing cloth after fogging seems like a simple act, it does have impact on exposure to pesticides as been shown by the cholinesterase reduction among respondents. Following hygiene practices such as bath and changing clothes are among 4 safety behavior in using pesticides besides using personal protective equipment (PPE), appropriate practices in pesticide use and avoiding health risks (Sharifzadeh et al., 2019).

CONCLUSION

As a conclusion, health practice has a great impact with the cholinesterase percentage declination among the foggers. This study shows the significance of conducting medical surveillance among the healthcare workers especially the foggers. This study had also managed to detect a fogger with severe poisoning level which also gives a justification of the needs of sufficient PPE among the foggers to keep them protected from organophosphate poisoning. The usage of personal protective equipment, the fogging technique, and the cleaning process are all the aspects of health practice that has a great impact on the level of cholinesterase. The management should focus on ensuring the adequate supply of PPE, giving sufficient education on handling pesticides and providing adequate shower rooms. On the other hand, the supervisors should ensure the compliance to the usage of PPE among the foggers and the foggers themselves should apply the health practice in their daily routine. As the impact of health practices is significant and essential among the foggers, everyone should play their role in apply in health practice in order to decrease the exposure of organophosphate pesticide among the foggers. Besides the compliance to PPE, all intervention based on the Hierarchy of Control should be carried out together. Therefore, health practice should be emphasis among all foggers in vector unit in order to protect them from organophosphate pesticide poisoning.

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