ORIGINAL ARTICLE

Knowledge, Attitude and Practice (KAP) on Pesticide Exposure Among Farmers in Kota Bharu, Kelantan

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ABSTRACT

Introduction: : The increased pesticide usage is due to intensification of agricultural sector. Pesticide is known to give an adverse effect to human health and environment. This study aims to investigate the level of knowledge, attitude and practice (KAP) on pesticide exposure among farmers. **Methods:** A cross sectional study was conducted among vegetable and fruits farmers in the district of Kota Bharu, Kelantan. A modified KAP questionnaire was adapted and interviewed among 144 respondents. KAP level was constructed from the scores obtained. **Results:** About 85.4% of them were males with mean age of 48 years old, and 66% of them finished secondary school. The respondents' complaint that they had experienced symptoms such as excessive sweating (34.7%), blurred vision (27.1%) and numbness in legs (22.9%). Around 63% of farmers stored the pesticide bottle at designated place, while 62% wore personal protective equipment during spraying pesticides. About 61.1% of respondents had moderate knowledge of the pesticide used, 56.3% of them showed a not concern level of attitude towards pesticide usage, and 21.5% of them indicated a good practice while handling the pesticide. Significant correlation was observed between attitude with knowledge and practice ($p<0.001$), respectively. No correlation was found between knowledge and practice ($p=0.142$). Education level was shown to be the influencing factor for knowledge, while gender and age were the influencing factors for practice ($p<0.05$). **Conclusion:** Improvements in pesticide safety education should be conducted to minimize the risk from pesticide application, thus help the farmers' quality of life becomes better.

Keywords: Knowledge, Attitude, Practice, Agricultural worker, Pesticide usage

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INTRODUCTION

The agricultural sector contributed RM 99.5 billion (7.3%) to Malaysia's Gross Domestic Products (GDP) in 2018 (1). From this figure, oil palm dominated the contribution, as much as 37.9%, followed by other crops, such as vegetables, fruits and paddy, which shared 25.1%. Working in an agricultural setting may impose a hazardous working condition to the workers. They may be exposed to machinery hazard, awkward posture and contact with chemicals, which is pesticide. The pesticide has been used by most agricultural workers in their farm to minimize the damage caused by weeds, pest, and to increase crops productivity (2). Pesticides are defined as any substance used in controlling, preventing, destroying, weeding, repelling, relieving or reducing pest (3). The usage of chemical pesticide is a common practice in Malaysia because the traditional system in vegetable plantation could not help in destroying pests' infections. Pesticide exposure can pose an adverse effect on health, such as poisoning for acute effect, and work-related cancer and even death for chronic effects (4). In fact, the pesticide can cause environmental problems too. Factors that contributed to the health problems include the duration of exposure to the pesticide, the type of pesticide used and the health status of an individual (3). Pesticide can be grouped into several types, includes insecticide, herbicide, rodenticide, bactericide, fungicide and larvicide (5). Findings from the interview showed that Roundup (a type of herbicide), Meothrin (a type of insecticide) and Captan (a type of fungicide) are among the most commercially used pesticides along with other various mixtures of chemical with active ingredients. Meanwhile, the main crops in Kelantan are paddy for the seasonal crop, and

chilli and watermelon are the non-seasonal crops.

Excessive exposure to a pesticide in the workplace can threaten the health of the farmworkers. Excessive use of pesticides in an oil palm plantation, fruit and vegetable farms could cause blurry vision and headache among applicators due to the exposure of all year round (6). This situation could lead to an increase in occupational poisoning since the working environment was exposed to this chemical hazard. Majority of the farmers were found to be unaware of the hazard and risk of not applying pesticide correctly despite receiving training on the proper use of pesticides (7). Approximately, about 14.5% of the farmers in vegetables and fruits farms in Pahang had reported to experience pesticide poisoning symptoms. Meanwhile, 72% rice farmers in Tanjung Karang, Selangor complained of pesticides poisoning symptoms due to the fact that they admitted seldom worn the personal protective equipment (PPE) when handling the pesticides (8). A cross-sectional study was conducted among farmers in Cameron Highlands, Pahang and farmers in Bachok and Pasir Putih, Kelantan.

Interestingly, the result of the study showed that farmers in Kelantan had a higher prevalence of hyperglycaemia, hypercholesterolaemia, anaemia and systolic hypertension compared to the farmers in Cameron Highlands, Pahang (9). The reason behind these results was due to the lack of awareness on PPE usage, which had increased the risk of getting intoxicated by the pesticide. Factors such as nutritional status and farmers' lifestyle also contributed to this high percentage.

It is crucial to assess the level of knowledge, attitude and practice (KAP) on pesticide exposure among farmers. Thus, the objective of this study was to determine the level of KAP among the farmers. The results obtained can be used as baseline data specifically for vegetables and fruits farmers. Furthermore, the results can suggest intervention measures to empower the farmers' KAP. Other than that, the results of this study may help the government agencies to realize the KAP level of the farmers and suggest a better training and educational program for them.

MATERIALS AND METHODS

Study design, location of study and criteria of subjects

A cross-sectional study was conducted at vegetables and fruit farms located in Kota Bharu, Kelantan. Watermelon and chillies were among the products of the farms. The study was conducted from January to May 2019. Written consent was obtained from the Kelantan State Department of Agriculture (DOA) along with a list of farmers and farms located in the district of Kota Bharu. The name list consisted of the farmers that were registered with the Kelantan State Department of Agriculture. There were several inclusion criteria for the farmers to meet as a respondent. The inclusion criteria included farmers must voluntarily participate, the minimum age was 18 years old and above, able to read and write in Bahasa Melayu, working as a full-time farmer and used pesticides in their farming process. Farmers that had working experience less than six months were excluded from this study.

Questionnaire

A modified questionnaire adapted from previous KAP study from Marina Mior et al. (10) and Mazlan and How (11) was used. The questionnaire consisted of 53 KAP questions in total and was divided into five sections, namely:

i. Section A described the respondents' background information. Questions on gender, marital status, age, race and educational level of the farmers were included in this section. Frequency in spraying pesticide and the type of pesticides used whether it was a fungicide, rodenticide or insecticide were asked.

ii. Section B assessed the health symptoms of the subjects on the use of pesticides for the past three months, which was adopted from the previous study (11). Questions regarding whether the subjects had experienced dizziness, nausea, vomit, blurred vision and stomach ache were included. Fourteen types of health symptoms were assessed in this section.

iii. Section C included questions on Knowledge of pesticide usage. This included the hazard when using or spraying the pesticide, the health effects when exposed to the pesticide in the long term, the classification of pesticide and pesticide's routes of entry. Question 1 to question 8 with yes or no option was scored on two-score points scale (0-1). Question 9 to question 18 included three questions that were assisted with pictures which comprised of a multiple-choice answer. One mark was given for each correct answer.

iv. Section D were questions on Attitude in using the pesticide. Questions on the proper use of Personal Protective Equipment (PPE), safe work procedures when handling the pesticide, and actions to be taken when visible symptoms occur were asked. Question 1 to question 12 with yes or no option, was scored based on a two-score points scale (0-1). For question 13 until question 17, that included four questions that were assisted with pictures were scored by choosing the correct answer. One mark was given for each correct answer chosen.

v. Section E was questioning on Practice in pesticide usage. Questions on safety precaution to be taken when using pesticide, training program attended before handling with pesticide, good labelling and storage of pesticide and safe pesticide disposal procedure were included. Question 1 until question 17, were scored based on a two-point scale (0-1) with yes or no option

and question 18 was scored by answering the correct answer and was given one mark.

The questionnaire was pre-tested beforehand to test the reliability of the questionnaire. Correction and adjustment were made to the ambiguity questions. The Cronbach's Alpha value in knowledge, attitude and knowledge sections showed an acceptable result (> 0.6). Table 1 shows the classification for knowledge, attitude and practice total scores which was adopted from the study by Mazlan and How (11).

Table I : Classification for Knowledge, Attitude and Practice total scores.

Score description	Knowledge	Attitude	Practice
Total > 80%	High	Concern	Good
61 – 80%	Moderate	Neutral	Fair
≤ 60%	Low	Not concern	Poor

Adapted from Mazlan and How (11)

Data Collection

The Human Research Ethics Committee of USM (JEPeM) had reviewed and approved this study (USM/JEPeM/18110645). The respondents were recruited using a purposive sampling method. The estimated sample size for this study was 180 respondents with 20% additional respondents to prevent dropout. The sample size was calculated by using a single proportion formula; based on the result of farmers' practice towards the use of pesticide as reported by Gesesew et al. (12), which was 89.6%. During data collection, a set of questionnaires was distributed to the subjects. Prior to that, a short briefing on the purpose and process of the study and how to answer the questionnaire booklet were given to them. Only those who fulfilled the study criteria and volunteered to participate were being given the booklet. Consent letter and information sheet were distributed as well. The farmers also were guaranteed that their personal information was being kept confidential. The farmers took around 15 minutes to complete all the questions in the questionnaire booklet. Then, the questionnaire was collected and was analyzed.

Data Analysis

The data were analyzed using IBM Statistical Package for Social Science Software (SPSS) version 24. Descriptive analysis was used to analyze the sociodemographic data of the respondents, health symptoms, the percentage and scores of correct answers in knowledge, attitude and practice on pesticide exposure. Pearson's Correlation test was used to indicate the strength of the association, and Regression was used to determine the contributing factors (educational level, age and gender) that influenced KAP on pesticide exposure among farmers.

RESULTS

Sociodemographic Information of the Subjects

The calculated sample size was 180 respondents. However, only 144 subjects were able to be recruited; thus, the response rate of this study was 80.0%. Table II describes the sociodemographic background of the respondents. The majority of the respondents were male workers (85.4%) compared to the other counterpart, female workers (14.6%). Only 5.6% of them were single while 94.4 % of them were married. The mean age for the farmers was 48 years old, and all the farmers were Malays. The highest educational level among the farmers was secondary education level (66.0 %), and as for working experience, majority of the farmers have been working for the past 10 to 19 years. The mean weight of the subjects was 70.62 kg. At the same time, the mean height was 168.31 cm. The most commonly used pesticide was herbicide (81.9%), followed by insecticide (76.4%) and rodenticide (42.4%). About 34.7 % of the farmers had no health problem. Majority of the respondents sprayed their crops about once in a week (66.0%), and some of them did it for every day (32.6%) and once a month (1.4%). Most of the farmers changed the PPE only when it has worn out (81.9 %). Seventy – six subjects (52.8 %) had attended a training program on pesticide handling, which were organized by State Department of Agriculture (26.4 %) and State Farmer's Organization Authority (26.4 %).

Health Symptoms of the Subjects

Table III shows that 34.7 % of the subjects experienced symptoms of excessive sweating and blurred vision (27.1 %). The next following symptoms declared by subjects were headache, cough and numbness in legs (22.9 % each). Meanwhile, 11.1 % of the subjects experienced numbness in hands, and some of them experienced chest pain (10.4 %). An only small percentage had symptoms such as nausea (2.8 %) and stomach pain (1.4 %).

Levels of Knowledge, Attitude and Practice

Table IV shows that only 7.6 % of the subjects had a high level of knowledge which contributed the least percentage in the Knowledge section. Meanwhile, for Attitude section, only 4.9 % had concern attitude level, and in the Practice section, 21.5 % had a good level of practice. In overall, the subjects had a moderate level of knowledge, not concern level of attitude and fair level of practice.

Correlation between Knowledge, Attitude and Practice

There was a positive and significant correlation between Knowledge and Attitude scores ($r = 0.342$, $p<0.001$). Also, there was a positive and significant correlation between Practice score and Attitude score ($r = 0.310$, $p<0.001$). However, there was no significant correlation between Knowledge and Practice score ($r = 0.123$, $p = 0.142$). The results were shown in Table V.

Contributing Factors (demographic factors) that Influence Knowledge, Attitude and Practice (KAP)

Simple Linear Regression (SLR) in Table VI shows that there was a significant association between Knowledge score and educational level ($b = 0.926$, $p = 0.030$) with

Table II : Socio-demographic information of the respondents (N=144)

Variables	Mean ± SD	n	Percentage (%)
Gender			
Male		123	85.4
Female		21	14.6
Marital status			
Single		8	5.6
Married		136	94.4
Age (years old)	48.69 ± 7.840		
20 – 29		3	2.2
30 – 39		10	6.9
40 – 49		72	50.0
50 – 59		49	34.0
60 – 69		10	6.9
Race			
Malay		144	100
Chinese		0	0
Indian		0	0
Nationality			
Malaysian		144	100
Educational level (years)			
Primary (UPSR)		20	13.9
Secondary(SRP/PMR/SPM/MCE)		95	66.0
Tertiary (Sijil/Diploma/Ijazah)		29	20.1
Work experience (years)	11.62 ± 6.301		
1 – 9		58	40.3
10 – 19		69	47.9
20 – 29		15	10.4
30 – 39		1	0.7
40 – 49		1	0.7
Weight (kg)	70.62 ± 5.190		
40 – 49		1	0.6
50 – 59		4	2.8
60 – 69		37	25.7
70 – 79		99	68.8
80 – 89		3	2.1
Height (cm)	168.31 ± 3.665		
155 – 159		8	5.6
160 – 164		9	6.3
165 – 169		58	40.3
170 – 174		68	47.2
175 – 179		1	0.6
Types of pesticide used			
Herbicide		118	81.9
Insecticide		110	76.4
Rodenticides		61	42.4
Health problems			
Hypertension		40	27.8
Skin diseases		10	6.9
Asthma		25	17.4
Diabetes Mellitus		40	27.8
Others		15	10.4
No diseases		50	34.7
Frequency of spraying pesticide			
Everyday		47	32.6
Once a week		95	66.0
Once a month		2	1.4
Once per two months		0	0
Once per six months		0	0
Frequency in changing of PPE			
Worn out		118	81.9
Expired		4	2.8
Once a year		13	9.0
Never		9	6.3
Attend training program on pesticide handling.		76	52.8
Yes		68	47.2
No			
If YES, agency involved:		38	26.4
State Department of Agriculture		38	26.4
State Farmers Organization Authority			

Table III : Health symptoms on the use of pesticides (N=144)

Health Symptoms	n	Percentage (%)
Headache	33	22.9
Cough	33	22.9
Nausea/Vomiting	4	2.8
Redness of skin	14	9.7
Breathing difficulty	9	6.3
Blurred vision	39	27.1
Runny nose	7	4.9
Chest pain	15	10.4
Sore throat	12	8.3
Redness of eyes	9	6.3
Stomach pain	2	1.4
Numbness in legs	33	22.9
Numbness in hands	16	11.1
Excessive sweating	50	34.7

Table IV : Distribution scores of Knowledge, Attitude and Practice (N=144)

Variables	Level	n	Frequency (%)
Knowledge	High	11	7.6
	Moderate	88	61.1
	Low	45	31.3
Attitude	Concern	7	4.9
	Neutral	56	38.9
	Not concern	81	56.3
Practice	Good	31	21.5
	Fair	91	63.2
	Poor	22	15.3

Table V : Correlation between Knowledge, Attitude and Practice scores

Variables		Attitude	Practice
Knowledge	r	0.342	0.123
	p-value	<0.001*	0.142
Practice	r	0.310	-
	p-value	<0.001*	-

*significant at p<0.001; Statistical test Pearson Correlation

Table VI : Factors influencing Knowledge, Attitude and Practice (KAP)

Knowledge[a]	b	p-value	95 % CI		R^2 (p-value)
			Lower bound	Upper bound	
Educational level	0.926	0.030	0.092	1.761	0.033 (0.030**)
Practice[b]					
Age	0.045	0.069	-0.004	0.093	0.056 (0.017**)
Gender	1.183	0.031	0.111	2.254	

[a]Simple Linear Regression, [b]Multiple Linear Regression

**significant at p<0.05

the R square of 0.033. Meanwhile, for Multiple Linear Regression (MLR), there was an association between Practice score with gender (b = 1.183, p = 0.031). The R square value was 0.056, with the p-value of 0.017.

DISCUSSION

Health Symptoms Associated with Exposure to Pesticide

The factors that could influence the risk of experiencing health problems after exposure to pesticides were the ingredient and compound of the pesticide and the duration of exposure to the pesticide (4). Some symptoms may occur immediately, or after several hours and others might develop after several years. Pesticide poisoning occurred in three stages; which were mild, moderate and severe poisoning (12). The findings of this study were in line for some symptoms such as breathing difficulty, blurred vision, chest pain and runny nose, which were described in the previous study (13). These farmers had been exposed to pesticide for a more extended period and disruption may occur to their health system. This may be due to the accumulation of organophosphate (OP) in the farmers' body, which triggers the symptoms to appear (14). Organophosphates and carbamate shared a similar mode of action towards the body. These types of pesticides act by inactivates acetylcholinesterase (AChE). This enzyme plays a vital function in the body by breaking down the neurotransmitter acetylcholine, which is found in both the peripheral and central nervous system (8). The inhibition would then have followed by the accumulation of acetylcholine, which would result in the overstimulation of the receptors, that explained the excessive sweating, numbness and headache symptoms. The more likely health symptoms to occur when the AChE level was lower. A study by Smit et al. (15) stated that there was a correlation between pesticide exposure, AChE level and health symptoms. A study which was carried out in China to determine the short-term and long-term effect of pesticide exposure demonstrated that long-term exposure is associated with abnormality of nerve conduction, especially the sensory nerves.

In comparison, short-term exposure may affect blood counts, hepatic and renal function of the body (16). The symptoms in the current study have similar results with symptoms reported among palm oil in Malaysia (11). The study stated that safe pesticide handling was influenced by knowledge and attitude level, which increased the capacity of self-reporting pesticide-induced health symptoms. A study conducted among rice farmers in northern Thailand showed that that prevalence of dry throat and cramp was associated with those who sprayed and mixed pesticide. In contrast, the numbness and diarrhoea prevalence was associated with those who scattered seeds. As for numbness and anxiety, it was associated with those farmers who harvested crops (17).

Knowledge, Attitude and Practice (KAP)

From this study, it was shown that the farmers' knowledge on pesticide's route of entry was low even though the majority of them had completed the secondary level of education. This result was contradicted with a previous study conducted, where all of the subjects had acquired the knowledge on pesticide entry to the body which was through nose, skin and mouth (18). This contradictory may be due to the lack of awareness among the farmers who used pesticide. Some of them still had misconception on the occupational route of pesticide exposure, even though the subjects had a high level of knowledge (19).

As for the attitude section, findings from this study showed that two-thirds of the subjects were not using proper containers (mineral bottles and beverage cans) to store pesticide leftover. Besides, a study conducted among Thailand farmers which revealed that 12.6 % used empty pesticide containers for household uses (20). In contradiction, a previous study conducted in Ethiopia showed a negative attitude where 77.2 % of the subjects used empty pesticide containers for other purpose and in the streets (28 %) (21).

In practice, only half of the subjects stored their pesticide package in the correct place, which was in the designated store. This value reflected the finding from a study conducted in Kuwait, where 59.0 % stored their pesticide in store designated only for pesticide (21). It was stated that those respondents with higher education level were less likely to keep pesticide in their home. Other than that, this current study found that only 61.8 % of the farmers wearing PPE (gloves, rubber boots and face mask) while handling the pesticide. This was due to a few factors such as low education level, lack of training, low income and discomfort when using PPE (22).

Correlation of Knowledge and Attitude, Knowledge and Practice and Attitude and Practice

The current study found that there was a significant correlation between attitude with knowledge and practice. However, the correlation between knowledge and practice was not significant. These findings were contradicted to a study conducted among chilli farmers in Thailand (23). The previous study stated that all knowledge, attitude and practice had positive correlation with each other. Some factors may contribute to the result of this current study. The insignificant correlation could be due to low education level.

In contrast, farmer with low education level may have difficulties to understand methods in using pesticide as being explained on the label. Findings from this current study supported this statement. Even though most of the respondents have a secondary educational level (66.0 %),

however around 52.1 % of them admitted to fully understand the information projected on the label of pesticide's bottle. Moreover, the results of this current study also contravened with a study conducted among maize farmers in Northern Thailand (20). The previous study found that there was a significant correlation between knowledge and attitude, knowledge and practice and attitude and practice. Almost two-thirds of the farmers had a positive attitude and a good level of practice. Whereas, in this study, more than half of the respondents had a not concern attitude level with fair practice level. Their attitude can sometimes be influenced by the training they attended and also from life experiences. In the meantime, a fair practice level reflected the application of instruction and knowledge that leads to real action. Thus, the combination of lack of awareness, incompetent training, low education background and blindly believed in hands-on experience may influence the respondents' knowledge, attitude and practice.

Contributing Factors that Influence Knowledge, Attitude and Practice (KAP)

A study conducted among Chinese farmers showed that gender had been associated with knowledge on pesticide use where men had a higher percentage on the knowledge about the adverse effects of pesticide compared to women (24). One of the factors that contributed to this finding in that study was women are less educated than men. Men have more ways to access information and resource about the pesticide. It was also reported that having an educational background may influence the farmers to be open-minded and able to learn new farming techniques (19). Other than that, findings from this current study found that gender might influence the Practice of an individual. A previous study that studied on gender differences in pesticide knowledge, awareness and practices found that more male farmers used pesticides when compared to female and they did correctly dispose the pesticides containers, while a few male farmers practiced protective behaviours or measures when applying pesticides to crops (25). The previous study also suggested that an educational program with gender-sensitive method may be implemented to increase the awareness and encourage good practice towards the farmers. This may explain why such contradiction occurred.

The limitation of the study that can be observed was that this study was only determining the KAP level without any intervention measures, to assess before and after the intervention program. Besides, the sample size obtained could not be generalized to the whole farmers' population in Kelantan. Larger sample size is recommended to foresee the significant association, as well as to be able to conclude the population. However, the result of this study provides a reliable baseline data for future research to be carried out. As for the recommendation, the Department of Agriculture may help to identify those farmers who have not attend the provided training. More comprehensive and intensive training programs and campaign on the proper use of pesticide could be executed among the farmers who exposed to pesticides. Other than that, the interventional study is suggested to be done for future research to foresee the pattern of KAP level. Health assessment program can be conducted among the exposed farmers, along with a collection of biomarker samples to determine the severity of pesticide poisoning.

CONCLUSION

In conclusion, the results have shown that the respondents had a moderate level of knowledge on the pesticide used. Most of them also showed a not concern level of attitude towards pesticide usage, and one-fifth of the respondents showed a good practice level. It is essential to determine the level of knowledge, attitude and practice of the farmers on pesticide exposure as well as to assess the health symptoms of the farmers. Necessary actions need to be taken in order to take care of their safety, health and welfare as workers. Findings from this study can encourage the local authorities and the employers to educate, motivate and provide support for agricultural workers to improve their quality of life. Furthermore, data obtained from this study will provide information for policymakers and future researchers.

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