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Empowering Groups of Farmer Exposed to Pesticides Pollution in Jembrana District

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Abstract

Pesticides are chemicals that are regularly used by farmers to manage pests. The adverse effects of pesticides affect not only pests but also farmers working without proper and correct personal protective equipment (PPE). The Eastern (Kangin) and Western (Kauh) groups of local farmer association, called the Tegal Wani Subak, in the Jembrana sub-district are farmer the groups that use pesticides regularly. Several health symptoms related to pesticides/ organophosphates exposure such as skin redness, eye irritation, dry throat and dizziness have frequently occurred. Based on field observation and discussion with participants, none of the farmers completely equipped with PPE and the farmers was exposed to pesticides contamination. Occupational Health and Safety (OHS) induction program was conducted to increase awareness, knowledge and practices of the farmers on the hazards of pesticides, early detection of pesticide poisoning and preventive interventions based on OHS approach. This program was an interventional study with a pre-post test approach which was participated by seven farmers and evaluated for one month. The pre-test results showed an improvement in the participants' knowledge from 28.7 %, to 84.3 %. The general results of Focused Group Discussion (FGD) revealed that participants had a good understanding of pesticides; however, the understanding of PPE remained low. Weekly observations and assessments showed that the use of PPE had increased by 100%, except for boots use (71%); all health symptoms decreased to 0%, except those related to nervous systems which actually increased from 71% to 76% (45% reported of hyperhydration/hypersalivation and 71% reported of headaches). The sustainable and active involvement of OHS officers in primary health centre (Puskesmas) is very important to overcome the problem of organophosphate use in a wider population of farmers..

Keywords: Personal protection equipment, occupational health and safety, pesticides

Abstrak

[Pemberdayaan Kelompok Tani yang Mengalami Pencemaran Pestisida di Kecamatan Jembrana]

Pestisida adalah zat kimia yang rutin digunakan oleh petani dalam pengendalian hama. Efek pestisida tidak hanya berpengaruh pada hama, namun juga petani jika tidak menggunakan alat perlindungan diri dengan baik dan benar. Kelompok tani kangin dan kauh Subak Tegal Wani berada di wilayah Kecamatan Jembrana merupakan kelompok tani yang rutin menggunakan pestisida. Keluhan kesehatan seperti kemerahan pada kulit, iritasi mata, tenggorokan kering dan pusing saat penggunaan pestisida/organopofat sering dirasakan. Dari hasil pengamatan, tidak ada satu petani yang menggunakan alat pelindung diri lengkap. Berdasarkan pertemuan dengan mitra, dirumuskan permasalahan berupa kontaminasi pestisida pada kelompok mitra. Solusi yang disepakati adalah introduksi K3 sehingga petani mengetahui tentang bahaya penggunaan pestisida, mampu melakukan tindakan deteksi dini keracunan, dan mampu melakukan usaha preventif aplikasi K3. Kegiatan pengabdian ini merupakan studi intervensional dengan pendekatan pre-post test yang diikuti oleh tujuh orang mitra dan dievaluasi selama satu bulan. Hasil studi menunjukkan nilai pretest tingkat pengetahuan mitra sebesar 28,7% naik menjadi 84,3%. Hasil analisis FGD secara umum didapatkan gambaran bahwa mitra sudah memiliki pemahaman yang baik tentang pestisida namun masih rendah tentang APD. Dari hasil observasi dan penilaian mingguan didapatkan pemakaian APD sudah meningkat 100%, kecuali penggunaan boot (71%); semua keluhan mengalami penurunan sampai 0%, kecuali sistem saraf yang justru mengalami peningkatan 71% menjadi 76% (45% keluhan hiperhidrasi/hipersalivasi dan 71% sakit kepala. Peran aktif dan berkesinambungan petugas K3 Puskesmas sangat diperlukan dalam menanggulangi permasalahan penggunaan organoposfat pada populasi petani yang lebih luas.

Kata kunci: Alat perlindungan diri, kesehatan dan keselamatan kerja, pestisida

INTRODUCTION

The term of pesticides comes from the word "pest" which means pests and "cide" which means killing, so pesticides are literally interpreted as killing pests. The referred pests are microorganisms that disrupt and inhibits the growth of other organisms. According to the Minister of Health Regulation Number 07 / PERMENTAN / SR 140/2/2007 concerning on pesticides, pesticides are chemical substances or other materials and microorganisms and viruses that are used to 1) Eradicate/prevent pests of plant, 2) Eradicate grasses, 3) Kill leaves / prevent unwanted plant growth, 4) Regulate / stimulate plant growth, 5) Eradicate / prevent external pests in pets / livestock, 6) Eradicate / prevent waterborne pests, 7) Eradicate / prevent animals / microorganisms in household, 8) Eradicate / prevent animals that can cause disease in humans spreading through plants, soil or water. Pesticides are grouped into three main groups including insecticides, fungicides and herbicides.⁽¹⁾

Pesticides have certain active ingredients that can control the vectors of diseases (vector-borne diseases) and increase the productivity of agricultural products. The active chemicals of pesticides have several adverse effects on human health due to environmental contamination from the waters, soil and air. Pesticides are absorbed into plants and soil decomposing due to temperature, humidity and ultraviolet light, and evaporate in the air or spread following the flow of wind. Decomposition of pesticides occurs gradually, while the remaining pesticides then absorbed as residue.^(1,2)

The application of pesticide often exceeds recommended doses or being mixed with other chemicals to strengthen the toxic effects, which then increases the residual effect on the environment (the biomagnification effect) as it easily accumulates on the soil.^(1,2,3,4)

According to the Indonesian Ministry of Health data about monitoring of pesticide poisoning among farmers in 27 prov-

inces in Indonesia by observing cholinesterase enzyme activity, it was found that 61.8% of farmers were in the normal category, 1.3% had severe poisoning, and 26.9% had mild poisoning. These conditions did not necessarily cause symptoms that were realized by the farmers. The farmers were not aware that they had experienced latent poisoning. Various studies reported diseases and other medical symptoms arising from the use of organophosphate fertilizers, which include dizziness, sore eyes, dermatitis, shortness of breath, and others. The use of chemical fertilizers in the right doses and the use of Personal Protection Equipment (PPE) are the main preventive measures to reduce poisoning among farmers.^(5,6,7,8)

Dangintukadaya Village, located in Jembrana District, is one of the villages with a high level of pesticide use as pest control chemical. The farmers have used organophosphate pesticides in the village since the 1970s. According to a report from Agricultural Extension Officers (AEOs) at Jembrana, most of the farmers have never used PPE during application of pesticides in the field. The application of pesticides was reported to be overused during pest outbreaks. This will not only endanger the farmers but also other family members on regular exposure.^(9,10,11)

The Eastern (Kangin) and Western (Kauh) groups of Subak Sangkar Agung is the partner of this program. Based on meetings and communication with the members, we found that health problems (skin redness, eye irritation, dry throat and dizziness) appeared as the effect of spraying activities during pesticides application in the field.

OHS induction program can be one of the solutions for health problems occurred among the participants, so that the farmers gain knowledge about the hazards of using non-standardised application of pesticides, are able to carry out early detection of poisoning, and carry out preventive interventions following OHS practices such as the use of PPE.

METHOD

An interventional study with a pre-post test approach was conducted. The intervention consisted of training and mentoring were given to the participants for a month, while evaluation was conducted every week during the intervention period. The activities were attended by seven partners from the Western (Kauh) and the Eastern (Kangin) Groups from, local farmer association, Subak Tegalwani at Dangintukadaya. The participants were involved in FGD with indicators of attendance and active participation $\geq 85\%$.

Counselling and interactive dialogue about the use of pesticides and PPE were also given to the participants aiming for the improvement of participants' knowledge. During this activity, pre/post-tests were conducted with a target of $\geq 85\%$ improvement for participants' knowledge about pesticides/organophosphate.

The application of OHS includes the use of PPE in the form of hats, masks, long sleeves, aprons, latex gloves and boots to reduce health symptoms. Field observations were conducted every week for a month to measure the complete use of PPE among the participants when applying pesticides and to collect information about health symptoms related to pesticides/organophosphates exposure during mixing and spraying. The data, including the improved use of PPE and health problems 1-4 weeks after training and mentoring, were collected using questionnaire and analyzed descriptively.

RESULTS

This activity was attended by 4 members of the Eastern (Kangin) Farmer Group and 3 members of the Western (Kauh) Farmer Group Kauh of Subak Tegalwani, Sangkaragung. The pre/post tests were carried out using a questionnaire with 8 questions asking for: a general description of pesticides, the dangers of pesticides, signs of pesticide poisoning,

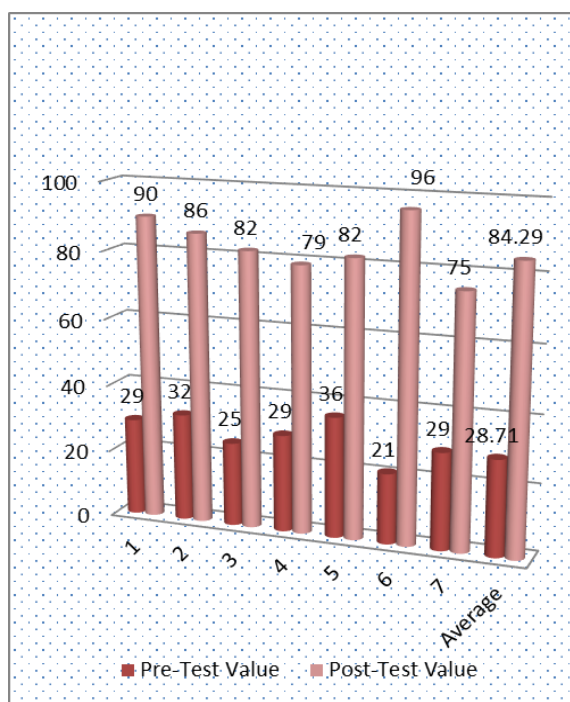
application pesticides (storage, mixing and spraying) and application of PPE (types, functions and techniques of correct use). The characteristics of the participants in this study can be described in Table 1.

Table 1. Characteristics of The Participants

No.	Age (year)	Gender	Educational status
1	40	Male	Junior high school
2	48	Male	Junior high school
3	55	Male	Junior high school
4	57	Male	Junior high school
5	48	Male	Elementary school
6	60	Male	Elementary school
7	62	Male	Elementary school

All participants are male and have no significant difference characteristics based on their age and educational background (elementary and junior high school) (Table 1.). The pre/post-test results of the participants can be seen in Figure 1.

Figure 1. Pre/Post-Test Assessment Results



The pre/post test results showed improvement among all of the participants, 100%, from test score of 28.71% to 84.29%, on average (Figure 1.). Topics were discussed during the FGD including 1) definition of pesticides; 2) types of pesticides; 3) hazards of pesticides, 4) signs of pesticide poisoning, 5) first aid for pesticide poisoning, 6) PPE, 7) the use and the benefits of PPE. The interpreted quote of statements from the respondents on each FGD topics is as below.

- In general, the participants have lack understanding about definition and type of pesticide.

"Pesticides are kind of liquid to kill pests of rice"

"The pesticide is for rice, what it's called? AEOs just asked us to use it, so we use it, we don't know what it's called "

"Pesticides are poisons, dangerous for humans. Can be carried by the wind, can stick on the leaves, in the vegetables, in the fruit that we will eat "

"What I know is only the one for rice... the liquid one just for rice."

"There are liquid pesticides, which are highly poisonous and which are mild."

- In general, the participants have the knowledge of OHS principles for mixing, spraying and post-spraying

activities.

"Anyway, when I mix the pesticides, I should use gloves ... I have mixed it without using gloves ... my hand is itchy and red.

"So do I! Spraying at 6 in the morning ... it is a must to wear clothes to cover mouth so it is not inhaled. "

"Once I sprayed without using PPE ... then it was a bad luck, the tube exploded... this body was burned, all of my back, I immediately fainted."

"If I spray it must be where there is no wind ... around 6 in the morning"

"After spraying, we are obliged to drink milk with young coconut waster, so the poison will be lost, he said. Then immediately take a shower, immediately wash our clothes "

- The participants have known the importance of wearing PPE properly when handling pesticides, often not to do so because of the effectiveness at work.

" I ... use cap, the long sleeve clothes will be directly wash after spraying. I do not have gloves. The boots are complicated to use in the rice fields, heavy in the mud "

" Mostly, I just use mask and long-sleeved shirt ... so it is simple"

" Sometimes, I use glasses when the wind is strong"

"I use rubber gloves, it is a must, my hand will be itchy if I am not using gloves "

"I should wear glasses to protect eyes, but ashamed to be seen"

- In general, the participants have complained about health problems due to their work as farmers using pesticides.

" I often feel itchy if I do not wear gloves when mixing, but I immediately wash my hands in the river using to reduce the itchy skin."

"I often get dizzy ...it is getting terrible after spraying, does it because I am not using mask? It is hard to breathe if I use mask"

"I have been feeling tired for the past year, even though my blood pressure is normal

said the doctor. It is exhausted, especially after spraying. I feel sleepy and just want to sleep. "

"If I am smoking when I spray, I feel sick (nausea) sometimes, my eyes get sore because of getting a little gas. But by just taking a shower and drinking coconut water, I feel better..."

- The solution offered by the partners to cope the subjective complaints from the use of pesticides is to provide regular counseling to farmers regarding pesticide poisoning signs / organoposfat and prevention. Here's the quote:

"...most of the people do not understand the importance of using mask ... so routine socialization and counseling must be done to make them remember".

"...this is a great socialization program, introduced tools that we can use then we could tell other farmers, so that all farmers are aware".

"... told us the symptoms of

Table 2. The observation results on mixing pesticides

PPE Kits	Week I		Week II		Week III		Week IV	
	PPE (participant)	%	PPE (participant)	%	PPE (participant)	%	PPE (participant)	%
Mask	4	57	6	86	7	100	7	100
Apron	1	14	5	71	7	100	7	100
Gloves	7	100	7	100	7	100	7	100
Long-sleeved clothes	6	86	7	100	7	100	7	100
Trousers	5	71	7	100	7	100	7	100
Boots	0	0	0	0	4	57	5	71

We found that the use of mask, aprons, gloves, long sleeves and trousers among the participants had reached 100% at the end of week 4; however, only five participants (71%) used boots at the end of week 4 (Table 2.). The interview results revealed

that the use of boots when mixing pesticides was reported to be less important because farmers already used rubber gloves. Burns on unprotected feet caused by the spillage of pesticides during mixing should be a concern.

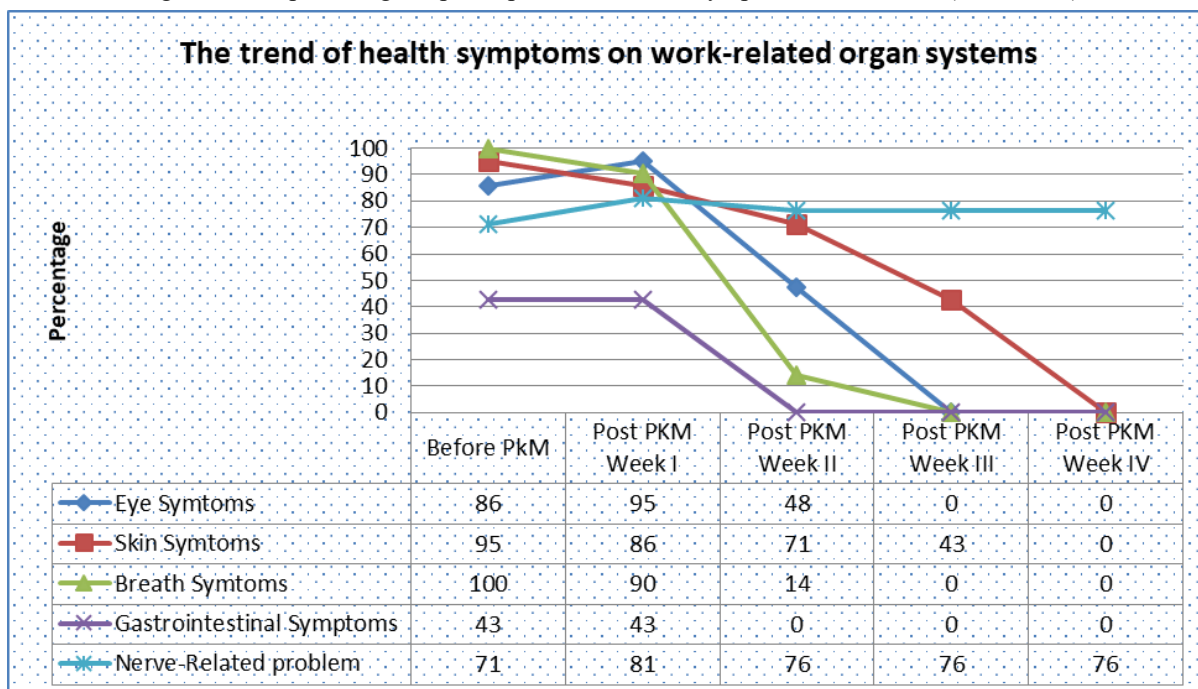
Table 3. The observation results on spraying pesticides/organoposphates

PPE Kits	Week I		Week II		Week III		Week IV	
	PPE (participant)	%	PPE (participant)	%	PPE (participant)	%	PPE (participant)	%
Hat/cap	2	29	6	85	7	100	7	100
Mask	7	100	7	100	7	100	7	100
Apron	0	0	1	14.3	4	57	6	85
Gloves	6	100	7	100	7	100	7	100
Long-sleeved clothes	7	100	7	100	7	100	7	100
Trousers	7	100	7	100	7	100	7	100
Boots	0	0	3	42	3	42	5	57

The trend of wearing hat/cap, mask, gloves, long sleeves and trousers among the participants increased to 100% at the end of week IV. The use of aprons and boots in

the first week were increasing from 0% from week I to 85% and 57% at the end of the week IV, respectively (Table 3.).

Figure 1. The percentage of participants with health symptoms due to work (Week I-IV)



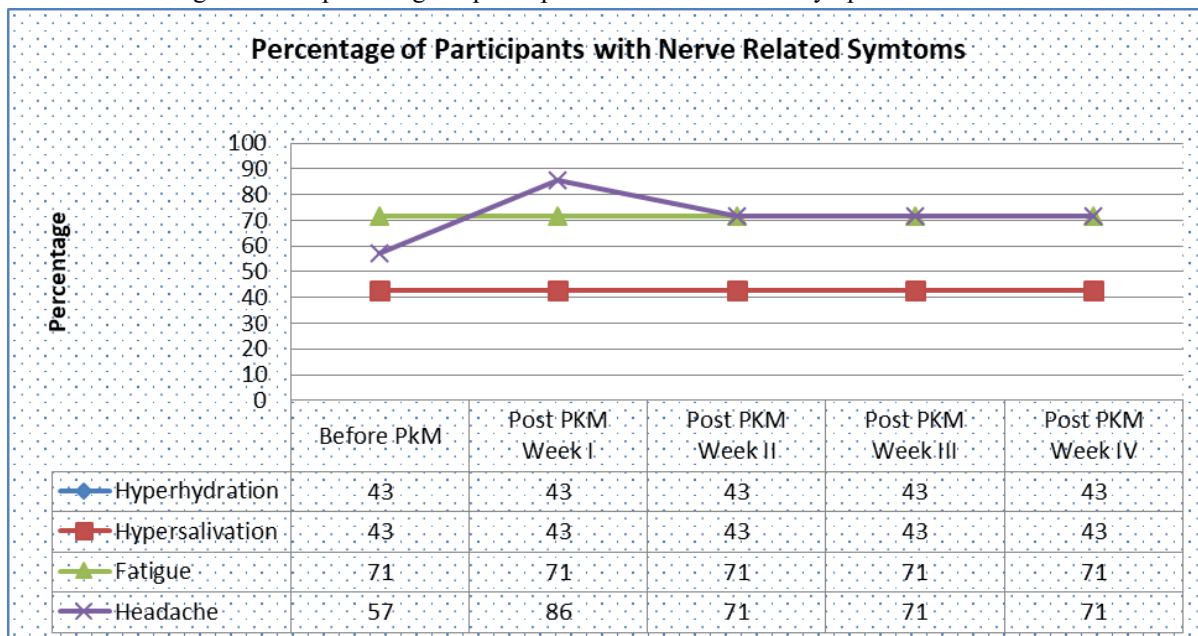
The trend of health symptoms on work-related organ systems generally decreased from prior of the program to week IV and the post-program (Figure 1.).

Breathing, skin, eye and gastrointestinal tract symptoms significantly decreased to 0%, while the participants with eyes, skin, breathing and gastrointestinal tract symp-

toms were 86%, 95%, 100% and 43% before the program, respectively. However, nerve-related symptoms reported among

the participants were not significantly different before and after the program (Figure 2.).

Figure 2. The percentage of participants with nerve related symptoms due to work



Reported nerve-related symptoms showed that most of the participants (71%) had fatigue, which has remained the same until week IV (Figure 2.). The proportion of participants with headache also increased from 57% before the program to 71% after week IV. Other symptoms such as hyperhydration and salivation were reported among 43% of the participants which remained the same until the week IV of the program.

DISCUSSION

The activities were participated by seven farmers who have similar characteristics such as age (range of 40-62 years) and education level (elementary and junior high school). The pre-test score after the training and mentoring was used to assess participants' knowledge about pesticides, pesticide hazards, signs of pesticide poisoning, pesticide applications (storage, mixing, spraying) and the use of PPE (types, functions and correct usage techniques). The average pre-test score was below 50%.

Meanwhile, the post-test results, after socialization were conducted, were increased from 28.7 % to 84.29%.

The results of the (FGD) illustrate that participants have a lack of knowledge in the classification of pesticides. The methods on the application of pesticides were given only in the form of instructions by AEOs about usage and application of pesticides. In certain conditions such as during pest attacks, most partners stated that they were applying the pesticide greater than recommended dosage without measurable dose based on their previous experience. Farmers using pesticides should ideally know the type and classification of pesticides and the application of each type to be able to choose the right pesticides according to the dosage needed. The results on this study correspond with a case study conducted by Catur, et al in Central Java in 2013 where 40.7% of the population did not know in detail the classification of pesticides. Meanwhile, 64.8% of farmers mixed pesticides based on the experience of fellow farmers.

Most farmers have known the principle of OHS at their work when mixing, spraying and post spraying pesticides. Most farmers have known as well the benefits of using PPE. However, they have not applied it properly work. This is because the use of complete PPE disrupts the mobilization and performance of farmers on muddy land. Observations on the use of PPE during mixing and spraying of pesticides showed that the use of complete PPE at the end of week 4 had reached 100 %, except for the use of apron and boots. The use of boots among participants reached 71% on mixing and 57% on spraying, while boots usage increased from 0% during the first week to 85% at week IV. These results confirm a study by Indah, et al in 2013, which found that the lowest use of PPE was the use of aprons and boots among farmers who were spraying pesticides. The farmers reported that the use of aprons and boots decreased their productivity as it made them difficult to move in the muddy field. These results were in accordance with a study conducted by Endah Retnani, et al. 2013 found that the lowest use of PPE were glasses and gloves (0%).

The incomplete use of some PPE by the farmers related to the effectiveness of using PPE and easiness to move at the field. The use of hats/caps, long-sleeve clothes and trousers are simpler than aprons and boot. The use of hats/caps is to protect the farmers from the sun, not to protect them from pesticide residues. The use of apron had experienced an increase from 0% in the first week to 85% in week IV. The use of apron is not maximal because the PPE kit is felt to be less efficient and less practical because it requires other people to do the installation. The trend of using boots had increased from 0% in the first week to 57% in week IV. The improvement was due to the AEO's warning to farmers, but the maximum use of this boot was due to muddy agricultural land which made it difficult for them to move when doing the spraying. Farmers are usually comfortable

using this PPE kit when the farm is hardened and does not result in their boots being submerged in mud. ^(12,13)

In general, all participants complained about pesticides-related health symptoms during their work. The groups of pesticide that cause poisoning including organophosphate, carbamate and paradichlorobenzene, which have been used by the farmer groups. Routine reported symptoms were itching on hands and feet, dizziness, nausea and sore eyes. The use of pesticides that abandons the use of PPE could irritate the skin and eyes (direct contact). Meanwhile, the effects of nausea are caused by ingestion of pesticide residues accidentally during smoking, talking, eating without washing hands or drinking polluted water. ^(9,10)

The trend of reported health symptoms related to pesticide use at work generally decreased from before the program to week IV after the program. Symptoms related to breathing, skin, eyes and gastrointestinal tract problems decreased to 0%. The reported eye, skin, breathing and gastrointestinal (nausea and vomiting) symptoms were 86%, 95%, 100% and 43%, respectively. Meanwhile, the reported nerve-related symptoms have no significant difference on before and after the program which was 71% to 76%, respectively.

According to some studies, acute poisoning due to the rapid reaction of pesticides is irritant contact dermatitis on the skin that is not protected by gloves and aprons, conjunctivitis in the eye that is not protected by glasses, shortness of breath due to not using a mask when spraying and nausea due to accidentally ingesting residues. Research by Endah, et al. 2013 also found that the most common health symptoms experienced by direct farmers after exposure were symptoms of airway obstruction (60.6%). Health problems that arise in each farmer's population can vary based on the trends in the existing practice on the use of PPE. ⁽⁷⁾

CONCLUSION

Both partner groups showed an active role in each activity of the program with a percentage of 87.5% attendance and 100% active participation. The pre/ post-test scores of the two partner groups experienced a 100% increase after training and mentoring. The FGD had been able to explore the knowledge of the farmers on pesticides/organophosphates and their perceptions of the important use of PPE, health symptoms and preventive actions related to use of pesticides during their work. On average, the use of PPE items had experienced an increase followed by a decrease in the trend of acute health symptoms, except for nerve-related symptoms.

SUGGESTION

We suggest that the two groups of the participants can be coached to conduct IEC to other members of Subak in delivering information about the importance of knowing good OHS practices at work. The health workers should conduct routine screening of cholinesterase inhibitor enzymes on farmers on a yearly basis to determine the poisoning level on farmers related to the use of pesticides.

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