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Subjective Health Complaints in Women Farmers Exposed to Pesticides in Agricultural Areas

Imelda Gernauli Purba[1,2*] dan Haryoto Kusnoputranto[3]

[1]Doctoral Program in Public Health, Faculty of Publich Health, Universitas Indonesia, Depok, Indonesia; e-mail: imelda@fkm.unsri.ac.id
[2]Environmental Health Program, Faculty of Publich Health, Universitas Sriwijaya, Palembang, Indonesia
[3]Department of Environmental Health, Faculty of Publich Health, Universitas Indonesia, Depok, Indonesia

ABSTRAK

Pestisida adalah bahan kimia yang semakin banyak digunakan terutama di bidang pertanian untuk mengendalikan hama tanaman. Pestisida tidak hanya memberikan manfaat tetapi juga menimbulkan dampak buruk bagi manusia, terutama jika tidak ditangani dengan baik. Wanita di daerah pertanian yang terpajan pestisida memiliki risiko mengalami gangguan kesehatan, terkait dengan keterlibatannya dalam kegiatan pertanian seperti penyemprotan, pencampuran pestisida, pencucian peralatan dan pakaian menyemprot. Penelitian ini bertujuan untuk menganalisis faktor risiko keluhan kesehatan subjektif akibat pajanan pestisida pada petani wanita. Jenis penelitian ini adalah observasional dengan pendekatan cross sectional. Populasi penelitian adalah petani wanita yang berdomisili di Kecamatan Sekayu, Musi Banyuasin Sumatera Selatan, dengan jumlah sampel 136, diambil dengan teknik Cluster. Pengumpulan data primer melalui wawancara dan observasi menggunakan kuesioner dan checklist. Analisis data menggunakan *Chi-Square Test*. Hasil penelitian menunjukkan bahwa keluhan kesehatan subyektif yang dialami oleh petani perempuan antara lain kelelahan, cemas, sakit kepala, pandangan kabur, mual, nafsu makan menurun, kelemahan otot, dan kejang otot. Beberapa variabel yang berhubungan dengan keluhan kesehatan subyektif antara lain umur (p=0,05), masa kerja (p=0,002), jumlah jenis pestisida (p=0,000), serta cara penyimpanan pestisida (p=0,021). Petani perempuan sebaiknya membatasi paparan pestisida dengan mengurangi lama kontak dengan pestisida, menghindari pencampuran berbagai jenis pestisida, dan menyimpan pestisida sesuai dengan tempat penyimpanannya.

***Kata kunci*:** Pestisida, Petani wanita, Keluhan kesehatan subjektif, Daerah pertanian

ABSTRACT

Pesticides are chemicals that are increasingly used particularly in agriculture to control plant pests. While pesticides offer benefits they also cause adverse effects on humans, especially if not handled properly. Women in agricultural areas exposed to pesticides are at risk of developing health problems related to pesticide exposure, which are often related to their involvement in agricultural activities such as spraying, mixing pesticides, washing spraying equipment, and clothing. The research aims to analyze the risk factors for subjective health complaints due to pesticide exposure in female farmers. The observational study employed a cross-sectional approach. The study population comprised female farmers exposed to pesticides residing in Sekayu District, Musi Banyuasin South Sumatra, Indonesia. A sample size of 136 was obtained through Cluster Sampling. Primary data were collected through interviews and observations using questionnaires and checklists. Data were analyzed using the Chi-Square Test. The results indicated that female farmers reported a range of subjective health complaints including fatigue, anxiety, headache, blurred vision, nausea, decreased appetite, muscle weakness, and muscle spasms. Several variables were associated with subjective health complaints including age (p=0.05), working period (p=0.002), number of types of pesticides (p=0.000), and storage method of pesticides (p=0.021). Female farmers should limit their exposure to pesticides by reducing the length of contact with pesticides, avoiding the mixing of different types of pesticides, and storing pesticides according to the storage instructions.

***Keywords*:** Pesticides, Women farmers, Subjective health complaints, Agricultural area

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1. INTRODUCTION

Women play an important role in the agricultural sector, accounting for 39% globally (UN Woman, 2020) and 24% of women in Indonesia work in agricultural (Kementerian Pemberdayaan Perempuan dan Perlindungan Anak, 2018). Involvement in

agricultural activities expose Women to pesticides. Agricultural pesticide use is increasing, in 2019 there were 4.2 million tons (Mt) of active ingredients, while worldwide pesticide application per cropland area was 2.7 kg/ha. Total pesticide use increased in 2010 by more than 50 percent compared to the 1990s, with pesticide use per cropland area increasing from 1.8 to 2.7 kg/ha. In 2019 Asia used the most pesticides in the agricultural sector (2.2 Mt), both in terms of total and per ha of agricultural land (3.7 kg/ha) (FAO, 2021). Pesticides are used by 53.2% of people in Asia and 29.3% of people in the Americas (Zhang et al., 2019).

Pesticide exposure is quite high when mixing and applying pesticides, using doses that are not as directed, mixing several types of pesticides, not using complete personal protective equipment, and improper application techniques (Filippi et al., 2021). Exposure to Organophosphate pesticides can cause a decrease in blood cholinesterase levels (Nambunmee et al., 2021)(Utami et al., 2021). This is due to the inhibition of the acetylcholine enzyme breaking down acetic acid and choline in the central nervous system. Organophosphate poisoning symptoms include increased salivation, diarrhea, vomiting, muscle tremors, gastrointestinal disturbances, and confusion (Hughes et al., 2021). Pesticide poisoning affects 500,000-1,000,000 people and kills 5,000-20,000 people worldwide each year with two-thirds of these incidents occurring in developing countries (Hadian et al., 2019). Studies in Tanzania mentioned organophosphate pesticide poisoning 28.7% of which occurred in adolescent women (Lekei et al., 2020). Poor agricultural practices in developing countries are a major source of dermal and oral pesticide poisoning (Kumari & John, 2019).

Sekayu District, located in Musi Banyuasin Regency, South Sumatra, is an area where most of the population relies on agriculture as a source of income. Women play an important role in the agricultural or plantation sector in Sekayu Sub-district. Women are at risk of pesticide exposure through agricultural activities, especially mixing, spraying, cleaning spraying equipment, and washing spraying clothes. The risk of exposure is even greater due to incomplete use of personal protective equipment and poor storage of pesticides in the home. Pesticide exposure can cause various health problems such as symptoms of pesticide poisoning. A preliminary survey of female farmers in Sekayu sub-district, Musi Banyuasin, revealed subjective complaints related to pesticide exposure. Starting from this problem, the aim of this research was to analyze the risk factors for subjective health complaints due to pesticide exposure in female farmers.

2. RESEARCH METHODOLOGY

This research was conducted after first passing the ethical review by the ethics commission of FKM Unsri, the respondents were given informed consent and signed it before the interview and observation. The design of this study was cross-sectional to analyze the relationship between pesticide exposure and effects at the same time. The study population was all women farmers exposed to pesticides in Sekayu District, Musi Banyuasin. A sample of 136 pesticide-exposed female farmers was selected using clustered sampling. The sample criteria were female farmers aged 17-45 years, not pregnant, and did not have a history of certain diseases.

The independent variables employed in this study were age, length of exposure, number of pesticide types, and storage methods. The dependent variable was subjective health complaints. The age categories were < 32 years and ≥32 years with the age cut-off point being 32 years. The working period was categorized as < 5 years and ≥ 5 years, and the number of pesticide types was categorized as <2 types and ≥2 types. The pesticide storage variables are divided into two categories: those that are considered to be correct if the score is less than 75%, and those that are considered to be correct if the score is equal to or greater than 75%. The dependent variable is the subjective health complaints related to pesticide poisoning symptoms, including fatigue, agitation, headache, blurred vision, increased saliva production, nausea, decreased appetite, weak muscles, and muscle spasms.

The data employed in this study was derived from primary sources, namely interviews conducted using questionnaires and observations made using checklists. The data set included information on the subjects' age, length of exposure, and the number of pesticide types used, and the storage methods employed. The data underwent a series of processing stages including editing, coding, entry, and data cleaning. The statistical analysis was conducted using the Chi-square test at a 5% level of significance.

3. RESULT AND DISCUSSION

3.1. Relationship between Age, Working Period, and Number of Pesticide Types with Fatigue

Complaints of fatigue were more likely to be experienced by respondents aged ≥ 32 years (80.6%) than those aged < 32 years, but there was no significant relationship between age and complaints of fatigue (p=0.270). Respondents with a working period as a farmer ≥ 5 years were more likely to experience complaints of fatigue than respondents with a working period < 5 years, meaning that the working period was associated with complaints of fatigue. The working period was significantly related to complaints of fatigue, where the working period was a protective factor against complaints of fatigue, meaning that the working period reduces the risk of 0.696 for complaints of fatigue. The number of types of pesticides once sprayed was related to complaints of fatigue. For respondents who used ≥ 2 types of pesticides per spraying and experienced complaints of fatigue were greater in proportion than those who used < 2 types. The number of pesticide types (p=0.000) was significantly associated with fatigue,

where the number of pesticide types was a protective factor against fatigue. The number of < 2 types of pesticides reduced the risk of 0.578 for the occurrence of complaints of fatigue. The pesticide storage method (p=1.000) was not significantly associated with complaints of fatigue in respondents, the complete data is presented in Table 1.

3.2. Relationship between Age, Working Period, Number of Pesticide Types, and Storage with Complaints of Restlessness

Complaints of restlessness tended to be experienced by respondents aged ≥ 32 years (40.3%) compared to those aged < 32 years, there was a significant relationship between age and complaints of restlessness (p = 0.05). Respondents with a working period as a farmer ≥ 5 years were more likely to experience complaints of anxiety (35.6%) than respondents with a working period < 5 years, meaning that the working period was associated with complaints of anxiety, but not significantly related (p=0.250). The number of types of pesticides sprayed at one time was associated with restlessness. Respondents who used ≥ 2 types of pesticides at one time and experienced complaints of anxiety were more likely than those who used < 2 types (37.5%). The number of pesticide types (p=0.037) was significantly associated with agitation, where the number of pesticide types was a protective factor against agitation. The number < 2 types of pesticides reduced the risk of restlessness by 0.467. Pesticide storage method (p=0.021) was not significantly associated with agitation. Poor storage of pesticides was a risk factor for agitation among respondents. The complete data is presented in Table 2.

3.3. Relationship between Age, Working Period, and Number of Pesticide Types with Headache Complaints

The results showed that headache complaints tended to be experienced by respondents aged ≥ 32 years (58.2%) compared to those aged < 32 years, but there was no significant relationship between age and headache complaints (p=0.593). Female farmers with working periods ≥ 5 years were more likely to experience headache complaints (59.8%) than those with working periods < 5 years, but there was no significant relationship between working periods and headache complaints (p=0.206). Female farmers who used ≥ 2 types of pesticides had a higher proportion of headache complaints (60.4%) compared to those who used < 2 types. The number of pesticide types (p=0.085) was not significantly associated with headache complaints. The pesticide storage method was not significantly associated with headache (p=0.805). The complete data is presented in Table 3.

3.4. Relationship between Age, Working Period, Number of Pesticide Types, and Storage with Complaints of Blurred Vision

The proportion of respondents with complaints of blurred vision was greater in the age group ≥ 32 years (31.3%) than those aged < 32 years (18.8%). The relationship between age and complaints of blurred vision was not significant (p=0.137). Female farmers with a working period ≥ 5 years were more likely to experience complaints of blurred vision (29.9%) than respondents with a working period < 5 years (16.3%) meaning that there was a relationship between working period with complaints of blurred vision but not significantly related (p=0.122). The number of types of pesticides sprayed once was associated with complaints of blurred vision. Respondents who used ≥ 2 types of pesticides and experienced complaints of blurred vision had a higher proportion (26%) than those who used < 2 types (22.5%). The number of pesticide types (p=0.828) was not significantly associated with complaints of blurred vision. The pesticide storage method (p=0.668) was not significantly associated with complaints of blurred vision. The complete data is presented in Table 4.

3.5. Relationship between Age, Working Period, and Number of Pesticide Types with Complaints of Increased Saliva Production

Female farmers with complaints of increased saliva production tend to occur in the age group ≥ 32 years (9%) compared to those aged < 32 years (4.3%), there was no significant relationship between age and complaints of increased saliva production (p=0.462). Working period was not significantly associated with complaints of increased saliva production (p=0.1000). The number of pesticide types was associated with complaints of increased saliva production. Respondents who used ≥ 2 types of pesticides and experienced complaints of increased saliva production, the proportion was greater (8.3%) than those who used < 2 types (2.5%). The number of pesticide types (p=0.385) was not significantly associated with complaints of increased saliva production. Female farmers with poor pesticide storage methods had a higher proportion of complaints of increased saliva production (7.4%), than female farmers with good storage methods (4.8%). The pesticide storage method was not significantly associated with complaints of increased saliva production. The complete data is presented in Table 5.

3.6. Relationship between Age, Working Period, Number of Pesticide Types, and aStorage with Nausea Complaints

Nausea tended to be experienced by respondents aged ≥ 32 years (11.9%) compared to those aged < 32 years (7.2%). This shows that there was an association between age and nausea complaints, but there was no significant relationship (0.523). Respondents with a working period ≥ 5 years were

more likely to experience complaints of nausea (12.6%) than respondents with a working period < 5 years (4.1%). Working period was not significantly associated with nausea (p=0.185). The number of pesticide types sprayed was associated with nausea. Respondents who used ≥ 2 types of pesticides and experienced nausea were more likely (10.4%) than those who used < 2 types (7.5%). The number of pesticide types (p=0.836) was not significantly associated with nausea among female farmers. Pesticide storage method (p=1.000) was not significantly associated with nausea among female farmers. The complete data is presented in Table 6.

3.7. Relationship between Age, Working Period, Number of Pesticide Types, and Storage with Complaints of Decreased Appetite

Complaints of reduced appetite among female farmers were more prevalent among those aged ≥ 32 years (16.4%) than those aged < 32 years (7.2%). The data showed an association between age and complaints of reduced appetite but did not prove a significant relationship (p=0.163). Respondents with working period ≥ 5 years were more likely to experience complaints of reduced appetite (13.8%) than respondents with working period < 5 years (8.2%) meaning that working period was associated with complaints of reduced appetite, but did not show significant relationship (p=0.483). The number of pesticide types was not significantly associated with complaints of decreased appetite (p=0.295). Female farmers with poor pesticide storage methods were more likely to experience complaints of decreased appetite (14%) compared to farmers with good pesticide storage methods (4.8%). The pesticide storage method was not significantly associated with complaints of reduced appetite among respondents (p=0.160). The complete data is presented in Table 7.

3.8. Relationship between Age, Working Period, and Number of Pesticide Types with Muscle Weakness Complaints

The proportion of complaints of muscle weakness was greater in respondents aged ≥ 32 years (13.4%) than those aged < 32 years. Age was not significantly associated with complaints of muscle weakness (p=0.742). The working period of female farmers was not significantly associated with complaints of muscle weakness (p=0.684). A number of pesticide types once sprayed was associated with complaints of muscle weakness. The number of pesticide types (p=0.295) was not significantly associated with complaints of muscle weakness. The pesticide storage method was not significantly associated with complaints of muscle weakness (p=0.406). The complete data is presented in Table 8.

3.9. Relationship between Age, Working Period, Number of Pesticide Types, and Storage with Muscle Spasm Complaints

Female farmers aged ≥ 32 years had a higher proportion of muscle spasm complaints (16.4%) than those aged < 32 years. The age of respondents was not significantly associated with muscle spasm complaints (p=0.270). Respondents with a working period as a farmer ≥ 5 years were more likely to experience muscle spasm complaints (14.9%) than respondents with a working period < 5 years (8.2%). The working period was not significantly associated with complaints of spasms in respondents (p=0.380). The number of types of pesticides was significantly associated with complaints of muscle spasms (p=0.393). The pesticide storage method (p=0.674) was not significantly associated with complaints of muscle spasms. The complete data is presented in Table 9.

Table 1. Relationship Between Age, Working Period, and Number of Pesticide Types with Fatigue Complaints

Variables		Easily Tired				Total		P *value*	PR (95% CI)
		Yes		No.					
		n	%	N	%	N	%		
Age	< 32 Years	49	71	20	29	69	100	0,270	0,881 (0,728-1,067)
	≥ 32 Years	54	80,6	13	19,4	67	100		
Working period	< 5 Years	29	59,2	20	40,8	49	100	0,002	0,696 (0,543-0,892)
	≥ 5 Years	74	85,1	13	14,9	87	100		
Number of Pesticide Types	< 2 Types	20	50	20	50	40	100	0,000	0,578 (0,420-0,796)
	≥ 2 Types	83	86,5	13	13,5	96	100		
Storage	Bad	71	75,5	23	24,5	94	100	1,000	0,991 (0,808-1,216)
	Good	32	76,2	10	23,8	42	100		

Table 2. Relationship Between Age, Working Period, Number of Pesticide Types, and and Storage with Agitation Complaints

Variables		Restlessness				Total		P *value*	PR (95% CI)
		Yes		No.					
		n	%	N	%	n	%		
Age	< 32 Years	16	23,2	53	76,8	69	100	0,050	0,575 (0,342-0,967)
	≥ 32 Years	27	40,3	40	59,7	67	100		
Working period	< 5 Years	12	24,5	37	75,5	49	100	0,250	0,687 (0,390-1,212)
	≥ 5 Years	31	35,6	56	64,4	87	100		
Number of Pesticide Types	< 2 Types	7	17,5	33	82,5	40	100	0,037	0,467 (0,227-0,959)
	≥ 2 Types	36	37,5	60	62,5	96	100		
Storage	Bad	36	38,3	58	61,7	94	100	0,021	2,298 (1,115-4,736)
	Good	7	16,7	35	83,3	42	100		

Table 3. Relationship Between Age, Working Period, and Number of Pesticide Types with Headache Complaints

Variables		Headache				Total		P *value*	PR (95% CI)
		Yes		No.					
		N	%	n	%	n	%		
Age	< 32 Years	36	52,2	33	47,8	69	100	0,593	0,896 (0,662-1,214)
	≥ 32 Years	39	58,2	28	41,8	67	100		
Working period	< 5 Years	23	46,9	26	53,1	49	100	0,206	0,785 (0,557-1,108)
	≥ 5 Years	52	59,8	35	40,2	87	100		
Number of Pesticide Types	< 2 Types	17	42,5	23	57,5	40	100	0,085	0,703 (0,474-1,044)
	≥ 2 Types	58	60,4	38	39,6	96	100		
Storage	Bad	53	56,4	41	43,6	94	100	0,805	1,076 (0,767-1,510)
	Good	22	52,4	20	47,6	42	100		

Table 4. Relationship Between Age, Working Period, and Number of Pesticide Types, Storage with Blurred Vision Complaints

Variables		Blurred vision				Total		P *value*	PR (95% CI)
		Yes		No.					
		n	%	n	%	n	%		
Age	< 32 Years	13	18,8	56	81,2	69	100	0,137	0,601 (0,328-1,100)
	≥ 32 Years	21	31,3	46	68,7	67	100		
Working period	< 5 Years	8	16,3	41	83,7	49	100	0,122	0,546 (0,268-1,112)
	≥ 5 Years	26	29,9	61	70,1	87	100		
Number of Pesticide Types	< 2 Types	9	22,5	31	77,5	40	100	0,828	0,864 (0,444-1,286)
	≥ 2 Types	25	26	71	74	96	100		
Storage	Bad	22	23,4	72	76,6	94	100	0,668	0,819 (0,449-1,496)
	Good	12	28,6	30	71,4	42	100		

Table 5. Relationship Between Age, Working Period, and Number of Pesticide Types with Increased Saliva Production Complaints

Variables		Increased Saliva Production				Total		P *value*	PR (95% CI)
		Yes		No.					
		n	%	N	%	n	%		
Age	< 32 Years	3	4,3	66	95,7	69	100	0,462	0,486 (0,127-1,863)
	≥ 32 Years	6	9	61	91	67	100		
Working period	< 5 Years	3	6,1	46	93,9	49	100	1,000	0,888 (0,232-3,394)
	≥ 5 Years	6	6,9	81	93,1	87	100		
Number of Pesticide Types	< 2 Types	1	2,5	39	97,5	40	100	0,385	0,300 (0,039-2,321)
	≥ 2 Types	8	8,3	88	91,7	96	100		
Storage	Bad	7	7,4	87	92,6	94	100	0,835	1,564 (0,339-7,213)
	Good	2	4,8	40	95,2	42	100		

Table 6. Relationship Between Age, Working Period, and Number of Pesticide Types, Storage with Nausea Complaints

Variables		Nausea				Total		P *value*	PR (95% CI)
		Yes		No.					
		n	%	n	%	n	%		
Age	< 32 Years	5	7,2	64	92,8	69	100	0,523	0,607 (0,209-1,761)
	≥ 32 Years	8	11,9	59	88,1	67	100		
Working period	< 5 Years	2	4,1	47	95,9	49	100	0,185	0,323 (0,075-1,398)
	≥ 5 Years	11	12,6	76	78,7	87	100		
Number of Pesticide Types	< 2 Types	3	7,5	37	92,5	40	100	0,836	0,720 (0,209-2,479)
	≥ 2 Types	10	10,4	86	89,6	96	100		
Storage	Bad	9	9,6	85	90,4	94	100	1,000	1,005 (0,328-3,082)
	Good	4	9,5	38	90,5	42	100		

Table 7. Relationship Between Age, Working Period, and Number of Pesticide Types, Storage and Decreased Appetite Complaints

Variables		Decreased Appetite				Total		P *value*	PR (95% CI)
		Yes		No.					
		N	%	N	%	n	%		
Age	< 32 Years	5	7,2	64	92,8	69	100	0,163	0,441 (0,162-1,202)
	≥ 32 Years	11	16,4	56	83,6	67	100		
Working period	< 5 Years	4	8,2	45	91,8	49	100	0,483	0,592 (0,202-1,736)
	≥ 5 Years	12	13,8	75	86,2	87	100		
Number of Pesticide Types	< 2 Types	7	17,5	33	82,5	40	100	0,295	1,867 (0,747-4,667)
	≥ 2 Types	9	9,4	87	90,6	96	100		
Storage	Bad	14	14,9	80	85,1	94	100	0,160	3,128 (0,744-13,151)
	Good	2	4,8	40	95,2	42	100		

Table 8. Relationship Between Age, Working Period, and Number of Pesticide Types with Weak Muscles Complaints

Variables		Muscle Weakness				Total		P *value*	PR (95% CI)
		Yes		No					
		n	%	n	%	n	%		
Age	< 32 Years	7	10,1	62	89,9	69	100	0,742	0,755 (0,298-1,912)
	≥ 32 Years	9	13,4	58	85,6	67	100		
Working period	< 5 Years	7	14,3	42	85,7	49	100	0,684	1,381 (0,548-3,478)
	≥ 5 Years	9	10,3	78	89,7	87	100		
Number of Pesticide	< 2 Types	7	17,5	33	82,5	40	100	0,295	1,867 (0,747-4,667)
Types	≥ 2 Types	9	9,4	87	90,6	96	100		
Storage	Bad	13	13,8	81	86,2	94	100	0,406	1,936 (0,582-6,438)
	Good	3	7,1	39	92,9	42	100		

Table 9. Relationship Between Age, Working Period, and Number of Pesticide Types, Storage with Muscle Spasm Complaints

Variables		Muscle Spasms				Total		P *value*	PR (95% CI)
		Yes		No					
		n	%	n	%	N	%		
Age	< 32 Years	6	8,7	63	91,3	69	100	0,270	0,530 (0,208-1,351)
	≥ 32 Years	11	16,4	56	83,6	67	100		
Working period	< 5 Years	4	8,2	45	91,9	49	100	0,380	0,546 (0,188-1,584)
	≥ 5 Years	13	14,9	74	85,1	87	100		
Number of Pesticide	< 2 Types	7	17,5	33	82,5	40	100	0,393	1,680 (0,688-4,102)
Types	≥ 2 Types	10	10,4	86	89,6	96	100		
Storage	Bad	13	13,8	81	86,2	94	100	0,674	1,452 (0,503-4,191)
	Good	4	9,5	38	90,5	42	100		

Pesticides enter the human body through the skin, mouth, eyes, and respiratory system, so acute illnesses associated with scientifically confirmed pesticides include headache, abdominal pain, vomiting, skin rashes, difficulty breathing, eye irritation, sneezing, seizures, and coma (Kalyabina et al., 2021). Organophosphates are one of the active ingredient classes of insecticides that are widely used in the agricultural sector. Symptoms and signs due to Organophosphate exposure that can occur are headache, hypersecretion, muscle twitching, nausea, diarrhea, vomiting, tachycardia/bradycardia, bronchospasm/bronchorrhea respiratory depression, seizures, and decreased consciousness (EPA, 2013). Symptoms and signs of Organophosphate poisoning can be grouped into three, namely muscarinic effects, nicotinic effects, and central nervous system. Muscarinic effects consist of miosis, bradycardia, hypotension, bronchorrhea, salivation, emesis, diarrhea, abdominal pain, disturbed urinary frequency, and heart rhythm disturbances. Nicotinic effects consist of symptoms of muscle fasciculation, muscle weakness, muscle paralysis, respiratory insufficiency, pale face, and sweating. Central nervous system effects include anxiety, agitation, tremors, changes in consciousness, hallucinations, convulsions, respiratory center inhibition, respiratory insufficiency, and hypothermia (Voicu et al., 2010).

Acetylcholine (AchE) is a nerve conductor present in the entire central nervous system, autonomic nerves, and somatic nervous system. Acetylcholine acts on sympathetic and parasympathetic ganglions, parasympathetic receptors, muscle nerve nodes, conducting nerve cells, and suprarenal gland medulla. Organophosphates have a mechanism of action of AchE inhibition, where they inactivate AChE by phosphorylating the serine hydroxyl group located on the active group of AChE. With various organophosphate insecticides, an irreversibly inhibited enzyme is formed. Signs and symptoms of intoxication become more prolonged and persistent. Without intervention, toxicity will persist until a sufficient amount of new AchE is formed, 20-30 days, to efficiently destroy excess Ach (Satoh, 2006).

The results showed that female farmers experienced complaints of fatigue, anxiety, headache, blurred vision, increased salivation, nausea, decreased appetite, muscle weakness, and muscle spasms. Research results of (Warno Utomo et al., 2019) mentioned that the complaints experienced by horticultural farmers who use pesticides include itching, sore eyes, body weakness, blurred vision, nausea dizziness and tightness in the chest. The research (Purba et al., 2023) mentioned several complaints experienced by crop farmers in North Dempo District who were exposed to pesticides were easily tired, restless, headache, blurred vision, increased salivation, frequent nausea, muscle weakness, skin itching, shortness of breath and coughing.

Fatigue is one of the most common complaints among female farmers in connection with exposure to Organophosphate pesticides through agricultural activities in Sekayu District, Musi Banyuasin. Complaints of easy fatigue are experienced by both age groups both in the younger and older groups with almost the same proportion so that no significant relationship between age and complaints of easy fatigue is proven. In contrast to the variable of age, the variables of working period and a number of pesticide types were associated with complaints of fatigue. Working period is the length of time (in years) farmers work as farmers, which is a factor that determines the intensity of pesticide exposure obtained by each farmer. The number of types of pesticides mixed in one spray certainly determines the toxicity that will be experienced by farmers, because there can be additive effects or synergistic

effects. The way pesticides are stored in the home environment is generally poor, this can be the cause of the meaningless relationship between the way pesticides are stored and complaints of fatigue. Poor storage methods will increase the risk of pesticide exposure for female farmers as well as other residents.

Agitation was experienced by 31.6% of the female farmers in this study. The number of types of pesticides is associated with complaints of restlessness in female farmers, where the number of types of pesticides is a protective factor against complaints of restlessness. The use of < 2 types of pesticides can reduce the risk of anxiety by 0.467 times. Complaints of feeling restless are included in the muscarinic effect and are classified as a mild level of poisoning (Jeyaratnam, J. and Koh, 2009). The pesticide storage method is a risk factor for anxiety, where respondents with poor pesticide storage methods have a 2 times greater risk of experiencing anxiety than respondents with good pesticide storage methods. Poor storage methods allow a greater risk of exposure to women farmers, for example, unqualified storage room ventilation causes room temperature to increase so that pesticides evaporate and may be inhaled by women farmers and family members. Careless placement of pesticides can contaminate the home environment.

Headache complaints were experienced by 51% of the respondents in this study, where headache is one of the typical symptoms of pesticide poisoning. Headache complaints were also experienced by farmers spraying horticulture in Meru County, Kenya (Marete et al., 2021). While in Buleleng Bali, headache was the most common complaint experienced by horticultural farmers (51.7%) (Minaka et al., 2016). Headache complaints experienced by female farmers are not related to exposure risk factors including length of service, number of types of pesticides, and how pesticides are stored. However, it is important to limit these exposure risk factors, because long-term exposure can cause complaints related to the effects of pesticides including headaches.

The complaint of blurred vision experienced by respondents in this study was not related to age, working period, number of types of pesticides, and how pesticides were stored. Blurred vision is a muscarinic effect and one of the symptoms of organophosphate poisoning which is classified as moderate poisoning (Jeyaratnam, J. and Koh, 2009).

The meaninglessness of the relationship between the working period and complaints of blurred vision can occur because blood cholinesterase concentrations can recover when resting from pesticide exposure, this causes no symptoms of poisoning in the form of blurred vision. The majority of respondents use more than two types of pesticides in one spray. This is done with the assumption that it will be more effective in eradicating pests so that they can get increased yields. Effects on the environment and human health have not been a consideration for respondents in the use of pesticides.

Increased saliva production is a muscarinic effect with symptoms of severe intoxication (Jeyaratnam, J. and Koh, 2009). Respondents who experienced increased saliva production in this study were only 6.6%. The small proportion of increased saliva production symptoms resulted in no significant relationship with age, working period, number of types of pesticides, and how to store pesticides. In theory, the number of types of pesticides affects the toxicity they cause. Research on farmers in Brebes proved a significant relationship between the number of types of pesticides with poisoning (Istianah & Yuniastuti, 2017). Research on farmers in Jember also proved a significant relationship between the number of active ingredients of pesticides used with the number of health complaints experienced by farmers (Sofiana et al., 2022).

Nausea is a symptom of moderate muscarinic effects (Jeyaratnam, J. and Koh, 2009). Frequent symptoms of nausea also occurred in respondents of previous related studies (Sofiana et al., 2022). The results of statistical analysis in this study did not prove a significant relationship, age, working period, number of types of pesticides, and how to store pesticides with symptoms of frequent nausea. Complaints of muscle weakness are not significantly related to, the working period, and the number of types of pesticides. Muscle weakness is one of the nicotinic effects of moderate intoxication symptoms (Jeyaratnam, J. and Koh, 2009).

One of the symptoms of moderate organophosphate poisoning is muscle weakness. Although age is not significantly associated with complaints of muscle weakness, cross-tabulation data indicates that female farmers in the older age group (≥ 32 years) experience a greater proportion of muscle weakness complaints than the younger group (< 32 years). The cross-tabulation indicates that female farmers with a working period of at least five years tend to experience greater muscle weakness than female farmers with a working period of less than five years. Female farmers who utilise two or more pesticide types per spray are less likely to experience muscle weakness than those who utilise fewer than two pesticide types. Female farmers who employ suboptimal pesticide storage techniques are more prone to developing muscle weakness than their counterparts who adhere to optimal storage practices.

The age of the respondents demonstrated a tendency to be associated with muscle spasm complaints, although this was not statistically significantly related. This can be observed in the cross-tabulation, where respondents with older age experience more muscle spasm complaints, which are significantly associated with muscle spasm complaints. Cross-Tabulation data shows that female farmers in the older age group (≥ 32 years) experience a greater proportion of muscle spasm complaints than the younger age group (< 32 years). The cross-

tabulation indicates that female farmers with a minimum tenure of five years tend to experience a greater proportion of muscle spasm complaints than female farmers with a tenure of less than five years. Female farmers who use two or more types of pesticides per spraying are less likely to experience muscle weakness compared to farmers who use less than two types of pesticides. Female farmers who use non-optimal pesticide storage techniques are more prone to muscle weakness compared to female farmers who use optimal storage techniques.

Symptoms and signs of Organophosphate poisoning can be grouped into three, namely muscarinic effects, nicotinic effects and central nervous system. Nicotinic effects consist of symptoms of muscle fasciculation, muscle weakness, muscle paralysis, respiratory insufficiency, pale face, and sweating (Voicu *et al.*, 2010). One of the symptoms of pesticide poisoning is muscle spasm, which belongs to the nicotinic effect.

A limitation of this study is that there has been no examination of female farmers' cholinesterase levels as a biomarker of the effects of pesticides, nor has there been any examination of metabolites to prove the presence of pesticides in the body.

4. CONCLUSION

Female farmers report a range of health complaints, including fatigue, anxiety, headache, blurred vision, nausea, decreased appetite, muscle weakness, and muscle spasms. The onset of these complaints is influenced by a number of factors, including age (p=0.05), working period (p=0.002), number of types of pesticides (p=0.000), and how to store pesticides (p=0.021). Female farmers should limit their exposure to pesticides by reducing the length of contact with pesticides, avoiding the mixing of different types of pesticides, and storing pesticides in accordance with the relevant storage requirements.

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