



Pesticide Exposure to Liver Function of Farmers in Rural and Remote Areas in Indonesia: A Correlational Study

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ABSTRACT

Farmers are uncovered to insecticides that effect liver featureproblems, in particularat some point of the pesticide spraying process. Several research have proven that there may be a hyperlinkamong liver harmrelated to pesticide use. This take a look atgoals to evaluate the depth of pesticide publicity to the liver featureproblems of farmers. Farmers on thistake a look athad been divided into companies, particularly farmers in rural regions and farawayregions. This take a look at is a quantitative descriptive take a look at with a cross-sectional take a look at approach. This studiesbecamecarried out in April - August 2020 in Indonesia, regardingforty farmer respondents from rural and farawayregions in Sumbawa Regency, Indonesia. The consequencesdisplay that chi-rectangulardesk values of duration of time running as farmers, a spraying method, and smoking conductmuch less than chi-square calculated in order thatthey may be no correlations with the bestquantity of S.G.O.T. and S.G.P.T. The chi-squareresultindicates a courtingamongusing P.P.E. with A.S.T. stageshowevernow no longer with the S.G.P.T. fee. The S.G.P.T. fee in eachcompaniessuggests a courtingamong the S.G.P.T. stage and P.P.E. due to the Chi-Square deskfeefee. The consequences confirmed that the duration of time running as a farmer, spraying method, and smoking conduct had no correlation with excessive stages of S.G.O.T. and S.G.P.T. amongst farmers in rural and faraway regions. Then using P.P.E. that isn't proper impacts the stages of S.G.O.T. and S.G.P.T. in farmers.

Keywords : Agriculture, Cross Section, Exposure, Farmer, and Liver Function.

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INTRODUCTION

Workers represent half of the world's population and are a significant contributor to economic and social development (Caraballo-Arias, 2015). The global workforce is currently around 2.8 billion; employees spend approximately a 3rd in their lifetime with inside the workplace. According to the I.L.O., one hundred sixty million employees be afflicted by occupational diseases.

More than 270 million go through work-associated injuries. About 2 million employees die in advance each year because of occupational diseases. There was respiratory, musculoskeletal, noise-induced hearing loss (N.I.H.L.), poisoning due to the occupation, skin diseases, infections, silicosis, cancer, and injuries. Workers expect a safe work environment as their fundamental human rights. However, there are still poor working conditions, especially in developing countries, due to a lack of simple precautions (Ahmad et al., 2016). The agricultural industry is one of the sectors that many Indonesians are engaged in. Most Indonesian people work as farmers who are a source of livelihood. Many farmers in Indonesia use pesticides, but they do not care and do not know the harmful effects of pesticides (Budiawan, 2014), especially liver function.

The liver has a significant role in glucose and lipid metabolism, helps the digestion process, absorbs fat and fat-soluble vitamins, and detoxifies the body against toxic substances (Rosida, 2016). Disorders and damage to the liver can interfere with essential liver functions in metabolism and detoxification. Aspartate amino transferase (A.S.T) or Serum Glutamic Oxsaloasetic Transaminase (S.G.O.T), Alanine amino transferase (A.L.T) or Serum Glutamic Pyruvic Transaminase (S.G.P.T), and alkaline phosphatase (alkaline phosphatase / A.L.P.) are some of the enzymes whose presence and levels in the blood are used as markers for disturbances Liver function. Damage to the liver will cause these liver enzymes to be released into the bloodstream so that levels in the blood increase and indicate impaired liver function (Siwiendrayanti et al., 2012). Most of the people of Indonesian work as farmers. The complete enumeration of the 2013 Agricultural Census showed that the number of food crop subsector agricultural business households in West Nusa Tenggara was 473274 households. Sumbawa Regency ranks 4th with a total of 54,053 rice crops (B.P.S., 2013). North Moyo District is one of the sub-districts with agricultural land with a harvest area of 3,618 hectares and a rice production yield of 18,429 tons (B.P.S.Kabupaten Sumbawa, 2016).

This research has never been done specifically on rice farmers in Sumbawa Regency. In addition, the aspects studied related to the conditions of SGOT and SGPT in farmers became one of the novelty aspects studied in this study. So far, the scope of research is only limited to descriptive aspects. This is in line with result of research that conducted by (Putri et al., 2021), pesticide compounds can also damage cell function, including damaging blood cells. In addition to blood cells, pesticides also interfere with other hematological parameters such as hemoglobin. This is due to the presence of chlorinated hydrocarbon groups that affect blood parameters. This research aimed to to compare pesticide exposure to liver function of farmers in rural and remote areas in Sumbawa.

There are variations feature among farmers in rural and far off areas. Many rural families are uncovered frequently to dangers from negative weather, illness, political instability, and financial mismanagement. The problem with vulnerability can be each intrinsic and tied to implications for profits technology and longer-time period out comes at the nutrition, health, and education of

children (Ogunmefun & Achike, 2015). Some big variations exist among rural and concrete populations and among rural and concrete fitness care transport systems. When movements on the nearby rural network fitness degree are planned, or facts on country wide coverage selections with implications for rural fitness is sought, it's miles vital to apprehend the precisetra its of rural groups, their environments, and the situations beneathneath which fitness care is added to rural populations. This method the attention of things as numerous as populace density, the remoteness of a network from huge city areas, the traits of the nearby workforce—and, even extra specifically, the traits of the agricultural fitness care workforce—and the cultural norms of the region, all of which have an effect on fitness and fitness troubles that rural groups face (Pool & Rusch, 2014). The safety of the fitness of the population, primarily based totally on huge safety, is inhibited and weakened via way of means of marketplace interests, which, in turn, have an institutional framework and law to offer approach to preserve the digital cycle of the economy, in prefer of the usage of technical merchandise with the assist of governments. This offers a capacity danger situation, normal of current society, in which income overrides the proper to fitness of people and the environment. The big use of insecticides because of the enlargement of agribusiness, further to intoxicating the population, is contaminating the food, water, and air (Silveira da Rosa & Silveira Cardoso, 2016).

This research refers to previous research which states that these effects of pesticides residues on cholinesterase and phospho mono esterase like that enzymes activities such as Aspartate Aminotransferase-AST, Alanine Amino trans ferase- ALT, Alkaline phosphatase-ALP in the blood of exposed persons (Agnandji et al., 2018). Pesticides are known to have possible toxicological modes of action to induce oxidative stress, mitochondrial dysfunction, and endoplasmic reticulum (ER) stress in living organisms (Lee & Choi, 2020).The results show that farmers' exposure to pesticides can occur up to 180 times per week. This is feared will disrupt the health system of farmers (Fuhrimann et al., 2020).Based on the background exposure and previous studies, the researcher feels the need to deepen this research. This is intended to find comparisons between farmers in urban and rural areas related to the effects of pesticide exposure.

METHODS

The study was carried out in two areas (Moyo Utara and Moyo Hilir) local Sumbawa District, Indonesia. Fishing, poultry, and vegetables are the main agricultural activities and primary sources of livelihood of the regions' people. Both local governments have about 800 farmers (population). A random sampling method was used in this study. The primary data were collected through a survey (questionnaire) and blood sampling of the farmers between June and July in 2020. Farmers were randomly selected from Moyo Utara and Moyo Hilir Local Government Areas of Sumbawa. A total of 40 household farmers were randomly selected and interviewed. The farmers

were interviewed to determine their univariate characteristics such as age, educational status, and long time working. Then bivariate data are the value of S.G.O.T., S.G.P.T., P.P.E., smoking habits, and how to spray of pesticide. Data gathered from the survey was analyzed using descriptive statistics (i.e., frequency and percentage) and cross-sectional approaches using Chi-Square analyses using S.P.S.S. for Windows Version 16.0.

RESULTS AND DISCUSSION

Characteristic of Respondent

Table 1. Characteristic of Respondent

Age Range (years old)	Frequency	Percent (%)
18-25	5	12.5
26-33	3	7.5
34-41	11	27.5
42-49	9	22.5
50-57	8	20.0
58-65	4	10.0
N	40	100.0
Length of work as Farmers (years)	Frequency	Percent (%)
1-2	4	10.0
3-4	17	42.5
>5	19	47.5
N	40	100.0
Education Level	Frequency	Percent (%)
Uneducated	1	2.5
Elementary School	17	42.5
Primary School	6	15.0
Senior High School	13	32.5
College	3	7.5
N	40	100.0

(Source: Primary Data)

Based on Table 1, the range of age respondents is 18 – 65 years old. The highest presentation was in the range of 34-41 years old. It showed the age of farmers, including on productive age category. 47,5% of respondents have a length of work as farmers for more than five years. It can be concluded that respondents have a long time enough to work as a farmer. The last

majority of respondents have education as elementary school graduated. It showed that they don't have a high education.

Serum Glutamic Oxaloasetic Transaminase (SGOT) and Serum Glutamic Pyruvic Transaminase (SGPT)

S.G.O.T. and S.G.P.T. are two types of enzymes produced by liver cells. Both of these enzymes are used as indicators in liver function tests. If the A.S.T. and A.L.T. levels increase in the blood, this is a sign of damage to the liver cells.

Table 2..Length of Work as a Farmer with S.G.P.T. and S.G.O.T. Group Rural Area levels

		SGOT			Total	X ² value	Sig value (2- sided)
		Normal 0- 42	Abnormal >42				
Length of Work as Farmer	1-2 years	3	4	7	6.555	0.038	
	3-4 years	0	11	11			
	>5 years	0	2	2			
Total		3	17	20			

		SGPT			Total	X ² value	Sig value (2- sided)
		Normal 0- 38	Abnormal > 38				
Length of Work as Farmer	1-2 years	4	3	7	2.251	0,324	
	3-4 years	4	7	11			
	>5 years	0	2	2			
Total		8	12	20			

Table 2.showed that S.G.O.T. and S.G.P.T. levels for farmers in rural areas are more than 50% in the abnormal category. This indicated that the levels of S.G.O.T. and S.G.P.T. in the hearts of farmers in this area are above the standard values that should exist. There is no relationship between the length of time being a farmer and the S.G.O.T. and S.G.P.T. levels in the liver. High levels of S.G.O.T. and S.G.P.T. in blood farmers do not directly indicate liver damage, but it is related to the intensity of exposure from the pesticide spraying process. (VoPham et al., 2017), states that pesticides are indeed related to liver damage, but not all aspects affect it (Perry et al., 2020).The same thing relate with research that conducted by (Hansen et al., 2020), results do not clearly support a causal link between exposure to cholinesterase-inhibiting insecticides and elevated blood glucose levels (expressed as HbA_{1c} and FPG), but results should be interpreted with caution due to the risk of reverse causality. The same thing is shown by the remote area group in Table 3.

Based on the chi-square value, there is no relationship between the length of work as a farmer and the S.G.O.T. and S.G.P.T. levels in the farmer's heart.

Table 3. Length of Work as a Farmer with S.G.P.T. and S.G.O.T.Group Remote Area levels

		SGPT		Total	X ² value	Sig. Value (2- sided)
		Normal 0-42	Abnormal >42			
Length of Work as Farmer	1-2 years	6	6	12	3.150	0.207
	3-4 years	1	5	6		
	>5 years	0	2	2		
Total		7	13	20		

		SGOT		Total	X ² value	Nilai Sig (2- sided)
		Normal 0-38	Abnormal > 38			
Length of Work as Farmer	1-2 years	7	5	12	7.179	0,028
	3-4 years	0	6	6		
	>5 years	0	2	2		
Total		7	13	20		

Personal Protective Equipment (P.P.E.)

Appropriate or inappropriate use of P.P.E. does not affect S.G.P.T. and S.G.O.T. activities. However, P.P.E. becomes urgent in order to lessen growers' contact with pesticides. Farmers in present research use P.P.E. regardless of its lack of procedure or standard. They use maskers during the spraying, notwithstanding its condition, which is able to reduce poison absorption primarily through inhalation. Research by Siwiendrayanti et al. (2012), argues that P.P.E. use does not affect liver function problems. The amount of pesticides correlates with S.G.P.T. activity due to S.G.P.T.'s nature as a transaminase enzyme manufactured by the cells of the liver (Siwiendrayanti et al., 2012). S.G.P.T. resides in cytoplasm of liver cells (Sherlock, 1995). Hepatocyte cells play role in biotransformation of toxins in the liver. Damage to hypocyte will make it permeable and allows leakage of S.G.P.T. into blood. Assumptions can be proposed to explain why some parameters of O.P. pesticide exposure correlate negatively with enzyme activity in the diagnosis of liver function problem. The first assumption, in normal circumstances organs, regenerate fast, in which liver cells are included. The second assumption, interaction of protective food and drink. A study by Sakr (2007), stated that ginger extract might repair the damage of the liver. Another research by El-Banna (2009), quoted in Siwiendrayanti et al. (2012), shows that garlic extract can repair liver damage due to pesticides Chlorpyrifos (Desimal & Mukono, n.d.).

The use of P.P.E. variable in this study showed no relation to the incidence of liver

function of farmer. In line with the research by disorders in peasant women in Bandungan village with $p = 0.531$. In this study, there were only 10 respondents of a total of 54 respondents who used a complete self-protection tool. Pesticides can get into the body through various means, among others can be through the respiratory tract or skin. One way to prevent the absorption of pesticides by the body is to use the Personal protective equipment (P.P.E.) to protect the body parts potentially as the main pathway of pesticides enters into the body. Exposure through channels respiration usually occurs when applying pesticide products without the use of protective. The reported respiratory symptoms related to exposure to pesticides include shortness of breath, wheezing, sore throat, cough, and chest tightness (Levine et al., 1997). Research reported almost using personal protective equipment every time they handled or applied pesticides (Staudacher et al., 2020).

Table 4. Appropriate Using P.P.E. with S.G.P.T. and S.G.O.T. Group Rural Area levels

		Appropriate Using P.P.E.			X ²	Sig. Value
		Appropriate	Inappropriate	Total		
SGOT	Normal 0-38	1	6	7	36.220	0.003
	Abnormal > 38	1	12	13		
	Total	2	18	20		
		Appropriate Using P.P.E.			X ²	Sig. Value
		Appropriate	Inappropriate	Total		
S.G.P.T.	Normal 0-42	0	7	7	21.197	0,274
	Abnormal >42	2	11	13		
	Total	2	18	20		

Based on Table 4 and Table 5, it shows that the use of P.P.E. in both rural and remote areas, the proper use of P.P.E. and according to standards is still lacking. Findings in the field show that farmers ignore the use of P.P.E. such as masks, gloves and hats when spraying pesticides. The chi square value shows that there is a relationship between the use of P.P.E. with A.S.T. levels but not with the S.G.P.T. value. The S.G.P.T. value in both groups shows that there is a relationship between the S.G.P.T. level and the use of P.P.E. because the Chi Square table value <the calculated Chi Square value.

Table 5. Appropriate Using P.P.E. with S.G.P.T. and S.G.O.T. Group Remote Area levels

		Appropriate Using P.P.E.			X ²	Sig. Value
		Appropriate	Inappropriate	Total		
SGOT	Normal 0-38	1	6	7	32,50	0.000

	Abnormal > 38	1	12	13		
	Total	2	18	20		
		Appropriate Using P.P.E.				
		Appropriate	Inappropriate	Total	X ²	Sig. Value
SGPT	Normal 0-42	0	7	7		
	Abnormal >42	2	11	13	31.197	0,027
	Total	2	18	20		

How To Spray Pesticides

The most dominant type of pesticide used by farmers from these two regions is the type of Organophosphates. Organophosphates are one of the maximum not unusual place and powerful pesticides with inside the agricultural industry. Due to the developing resistance of bugs and parasites to different styles of pesticide, using organophosphate chemical compounds stays giant with inside the agricultural industry (Perry et al., 2020). The process of spraying pesticides carried out by farmers in the field uses 2 systems, namely one in the direction of the wind and some in any direction. The time of spraying is also done on average in the morning, but there are also those who spray do not race against time. Tables 6 and 7 show that the majority of respondents spray according to the direction of the wind. They admit that this really helps the spraying process so that the droplets from the pesticides that are sprayed do not come back to them. The better a droplet is launched and the more potent the wind, the more the risk that a droplet will tour downwind and drift (Fishel & Ferrell, 2010).

Table 6. How To Spray Pesticide with S.G.P.T. and S.G.O.T. Group Rural Area levels

		Spraying Direction		Total	X ²	Sig. Value
		Any direction	Downwind			
S.G.O.T.	Normal 0-38	3	4	7		
	Abnormal > 38	6	7	13	34,230	0,78
	Total	9	11	20		
		Spraying Direction		Total	X ²	Sig. Value
		Any direction	Downwind			
S.G.P.T.	Normal 0-42	3	4	7		
	Abnormal >42	6	7	13	25,230	0,005
	Total	9	11	20		

Table 7. How To Spray Pesticide with S.G.P.T. and S.G.O.T. Group Remote Area levels

		Spraying Direction		Total	X ²	Sig. Value
		Any direction	Downwind			
SGOT	Normal 0-38	2	1	3	27,00	0.05
	Abnormal >38	6	11	17		
	Total	8	12	20		
		Spraying Direction		Total	X ²	Sig. Value
		Any direction	Downwind			
SGPT	Normal 0-42	3	5	8	30,40	0.002
	Abnormal >42	5	7	12		
	Total	8	12	20		

Based on Table 6, it is known that the method of spraying pesticides in the rural area group is not related to the existing S.G.O.T. and S.G.P.T. levels. Likewise, Table 7 shows that there is no relationship between S.G.O.T. and S.G.P.T. levels with the direction of spraying. How to spray the pesticide does not affect cholinesterase serum activity. The longer spraying activity, the higher are toxicities rate cases (Desimal & Mukono, n.d.).

The other research showed that appropriate pesticide dosage is associated with the incidence of organophosphate pesticide poisoning in farmer sprayers. Inappropriate dosages have a risk of four times for poisoning occurring than spraying is performed according to the rule dose (Amin et al., 2019). On Minaka's research in 2016 showed that 78.2% of total farmer respondents used pesticides exceeding the recommended dosage, and 58.5% suffered from health disorders or poisoning (Minaka et al., 2016). Spraying frequency does not affect S.G.P.T., A.L.P. and G.G.T. activities. In research, spraying frequency performed by the farmers is 1-2 times per week, which is considered normal.

Smoking Habits

Cigarettes comprise many poisonous materials and additives that motivate most cancers and are dangerous to health, which include nicotine, nicotine oxidants carbon monoxide, hydrogen cyanide and loose radicals (Tutuarima, 2018). Types of occupational publicity to insecticides have been assessed, which include applying, mixing, loading the sprayer tank, cleansing equipment, coming into a dealt with region following utility, washing infected clothing, being uncovered at some stage in transportation and garage having touch thru soaked garments with pesticide at some stage inutility and having touch with leaves containing pesticide residues (Faria et al., 2014). They admit that it is not uncommon for them to do these activities while smoking.

Table 8. Smoking Habits with S.G.P.T. and S.G.O.T. Group Rural Area levels

		Smoking Habits		Total	X ²	Sig. Value
		Yes	No			
S.G.O.T.	Normal 0-38	4	3	7	0,037	0,848
	Abnormal >38	8	5	13		
	Total	12	8	20		
		Smoking Habits		Total	X ²	Sig. Value
		Yes	No			
SGPT	Normal 0-42	5	2	7	0,568	0,444
	Abnormal >42	7	6	13		
	Total	12	8	20		

Both the rural and remote groups show that the levels of S.G.O.T. and S.G.P.T. have no correlation with the smoking habits of the farmers as shown in Tables 8 and 9. As many as 85% of farmers as a whole are active smokers who have been smokers for more than 1 year. 20% of respondents are smokers who admit to spraying pesticides while smoking without wearing P.P.E. Cigarette smoking poses an entire life mortality chance 2 times, a chance numerous orders of significance more than nearly another private chance (Fuhrmann et al., 2019). Furthermore, people who smoke standard earn much less than nonsmokers (Lestari et al., 2021). It can be concluded that farmer's smoker can contain more risk than nonsmokers farmer.

Table 9. Smoking Habits with S.G.P.T. and S.G.O.T. Group Rural Area levels

		Smoking Habits		Total	X ²	Sig. Value
		Yes	No			
SGOT	Normal 0-38	1	2	3	12,593	0,000
	Abnormal >38	17	0	17		
	Total	18	2	20		
		Smoking Habits		Total	X ²	Sig. Value
		Yes	No			
S.G.P.T.	Normal 0-42	7	1	8	0,093	0,761
	Abnormal >42	11	1	12		
	Total	18	2	20		

In this study, it turned intoproven that there has been no substantial dating among smoking hobby and excessive stages of S.G.O.T. and S.G.P.T. This is feasible due to the fact the quantity of cigarettes ate upeach day continues to be with inside the low category. A substantial growth in S.G.P.T. (Serum Glutamic Pyruvic Transaaminase) and S.G.O.T. can arise in lively smokers. Increased stages of S.G.P.T. (Serum Glutamic Pyruvic Transaaminase) considerably passed off in heavy smokers, however now no longer in mild and mild smokers. The toxicity of a substance is decided via way of means of the quantity of publicity or the quantity of cigarettes ate up. The greater cigarettes ate up, the better the chance of diverse diseases. This is like wise consistent with the studies via way of means of Roza et al, which confirmed that there has been no substantial dating among smoking conduct and excessive stages of S.G.O.T. and S.G.P.T. with inside the blood of farmers(Lestari et al., 2021).

CONCLUSION

The results showed that the length of time working as a farmer, spraying method and smoking habits had no correlation with high levels of S.G.O.T. and S.G.P.T. among farmers in rural and remote areas. Then the use of P.P.E. that is not right affects the levels of S.G.O.T. and S.G.P.T. in farmers.This study recommends for further researchers that it is necessary to deepen the variables to be studied. It is necessary to pay attention to the duration of work as a farmer and the history of liver disease experienced by the farmer. In addition, the dose of pesticide use can also be considered as another variable.

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