

**PESTICIDE EXPOSURE AND SYMPTOMS OF GASTROINTESTINAL DISORDERS AMONG  
FARMERS IN FOUR SELECTED BARANGAYS OF KAPANGAN, BENGUET**

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**A Thesis Presented to the  
Department of Medical Technology  
College of Natural Sciences**

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**In Partial Fulfillment  
of the Requirements for the Degree  
Bachelor of Science in Medical Technology**

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This is to further certify that GIAN CARLO G. CRUZ, RUBEN G. CUDIAMAT, LILANIE P. ABELLA, LILY AILEEN B. ALINAO, EDLYN V. BALLESTEROS, AUBREY D. DIWAS, LEORING JOY A. ESPINOZA, ELAINE ROSE B. FORTUS, and FE REMY ANN M. PAALAN are ready for oral examination.

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# CHAPTER I

## INTRODUCTION

### **Background of the Study**

Kapangan is a municipality of Benguet consisting of fifteen (15) barangays. It is generally an agricultural area with most of the people engaged in farming which serves as their main source of livelihood.

In farming, pesticide use may be necessary, for it aids the farmer in yielding a better harvest both for family consumption and for trade purposes. The pesticides used in the municipality are insecticides for insects, fungicide for disease causing fungi, and herbicide or weedicide for weeds that could outgrow the crops. These pesticides could increase production but when improperly used, it may also be harmful to the health of the user. Its compounds may enter the user's body through the gastrointestinal tract and could probably cause disorders. The consumers of the produce applied with pesticide could be affected, as well as the residents who utilize water from sources where agricultural run offs have accumulated.

Diarrhea is a symptom of gastrointestinal disorder which may be a result of microbial infection, chemicals and food poisoning. Diarrhea was noted in seven (7) barangays of Kapangan. In the year 2002, nine (9) cases of bloody diarrhea and fifty five (55) cases of acute watery diarrhea were recorded, while in 2003, seven (7) cases of bloody diarrhea and thirty six (36) cases of acute watery diarrhea were recorded. The researchers think that among these causative agents, pesticides directly or indirectly caused gastrointestinal disorders.

It is therefore the intention of the researchers to relate the gastrointestinal disorders with pesticide exposure among Kapangan farmers, in four selected barangays namely, Central, Datakan, Labueg, Paykek. About 63.60% are farmers in the four barangays having a total population of 7,471 as of year 2002. The four have total land area of 4,625 hectares, mostly are used for agricultural sources.

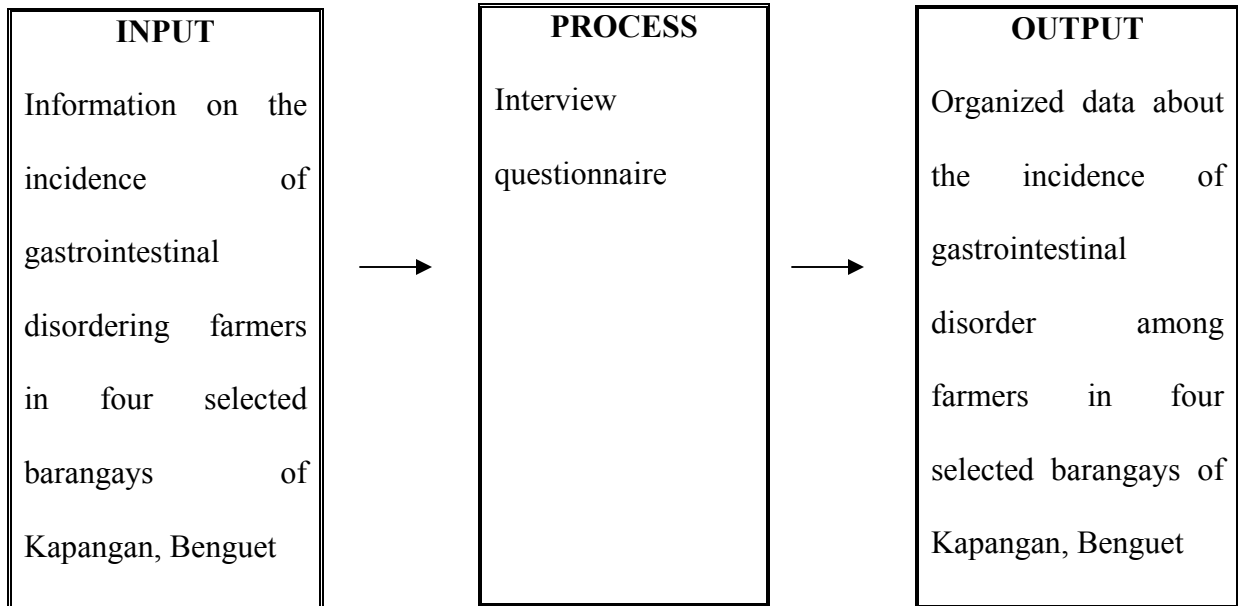
### **Theoretical Framework**

Pesticide usually accidentally enter the gastrointestinal tract through the mouth.<sup>1</sup> For example, a farmer who is applying pesticide and who smokes or wipes sweat off near the mouth unknowingly ingesting pesticide particles. Carbamate insecticides formulated in methyl alcohol and ingested can cause gastrointestinal irritations. 2,4-D and organo chlorides (component of pesticides) are moderately irritating to the gastrointestinal tract lining and causes vomiting, diarrhea and mouth ulcer.<sup>2</sup>

Loss of appetite and uncontrolled flow of saliva may mean acute toxicity. Organo phosphates and copper salts also irritate the gastrointestinal tract, and irritations are manifested as intense nausea, vomiting and diarrhea.<sup>3</sup> The health indicator of chronic gastritis is clinically characterized by epigastric tenderness and pain associated with nausea and vomiting.

## Paradigm of the Study

**FIGURE 1**



The paradigm of the study consists of three (3) essential points namely: the input, process, and output.

The input included the information on the incidence of gastrointestinal tract disorders among farmers in the four barangays of Kapangan, Benguet and in order to come out with these, the researchers utilized an interview questionnaire to gather the necessary data from the farmers.

## Assumptions

This study holds the following assumptions:

1. The farmers in four selected barangays of Kapangan, Benguet manifest symptoms of gastrointestinal disorders.

2. The incidence of gastrointestinal disorders are distributed according to locality, gender and age of the farmers, frequency of pesticide application, kind of pesticide used, and the manner of application.

### **Statement of the Problem**

The study aimed to relate the incidence of symptoms of gastrointestinal disorders to pesticide exposure among farmers in four selected barangays of Kapangan, Benguet.

Specifically, the researchers aimed to answer the following problems:

1. What is the incidence of symptoms of gastrointestinal disorders among:
  - a) farmers in four (4) selected barangays of Kapangan, Benguet
  - b) farmers using different kinds of pesticides.
2. Is the incidence of symptoms of gastrointestinal disorders related to:
  - a) gender
  - b) age
  - c) frequency of pesticide application
  - d) kind of pesticide
  - e) manner of application

### **Hypotheses**

To guide the researchers in the study, the following hypotheses were derived:

1. There is a significant difference in the mean or average incidence of symptoms of gastrointestinal disorders among:
  - a) farmers in four selected barangays of Kapangan, Benguet

- b) farmers using different kinds of pesticides
2. There is a significant difference in the mean incidence of symptoms of gastrointestinal disorders between:
    - a) the male and female farmers
    - b) the manner of application
  3. There is a significant relationship between:
    - a) age and incidence of symptoms of gastrointestinal disorders
    - b) frequency of pesticide of application and incidence of symptoms of gastrointestinal disorders

### **Scope and Limitations**

This study was only a survey limited to the determination of the incidence of symptoms of gastrointestinal disorders among farmers of four (4) selected barangays of Kapangan, Benguet. The relation of age, gender of the farmers, kind of pesticide used, as well as the frequency and manner of pesticide application to the incidence of symptoms of gastrointestinal disorder were determined statistically. The study also determined the source of water for domestic purposes and the distance of that water source from the agricultural lands may have been contaminated with pesticide and could possibly be associated with the gastrointestinal symptoms manifested by the farmers.

This study did not classify the symptoms as to what kind of gastrointestinal disorder it belongs to and did not employ any biochemical examination of stool samples from farmers to diagnose any condition associated with gastrointestinal disorder.

### **Significance of the Study**

Pesticides aid in yielding a good harvest, but pesticide use has its negative effects on health. Consequently, health problems can lower production capacity, which is detrimental to economic progress. As such, this study could be of assistance to agricultural countries including the Philippines in increasing the awareness to the detrimental effects of pesticide's misuse and abuse among concerned citizens. It is also helpful to the Health and Agricultural sectors of a country in planning programs of health measures to counteract the harmful effects and in controlling the misuse and abuse of pesticide use.

For the farmers, particularly the Kapangan farmers, it could help in increasing their awareness such that they become more cautious in their application and use of the pesticides.

To the part of the researchers, this study may develop and enhance skills that could be useful in their future profession as medical technologists.

### **Definition of Terms**

The terms used in the study are defined as follows:

*Age* – the length of time that a person has lived

*Diarrhea* – the frequent and repeated passage of stools which may be brought by infection in the gastrointestinal tract by microorganisms, chemicals, and food poisoning

*Farmers* – Cultivator of land to produce crops and vegetables

*Gastrointestinal disorder* – in the study, gastrointestinal would refer to any disturbance of abnormal condition in the gastrointestinal tract as manifested by abdominal pain, nausea, vomiting, salivating, and throat irritation, and gastrointestinal burn, difficulty in swallowing, perforation and internal bleeding.

***Gender*** – the state of being a male or a female

***Incidence*** – the number of cases based on the manifestation of symptoms of the gastrointestinal disorders mentioned in the questionnaire.

***Pesticide*** - chemicals used in farming to control or eradicate pest, weeds and disease causing fungi.

- Classified as:
  - a. Insecticides – for insects
  - b. Fungicide- for disease causing fungi
  - c. Herbicide/ weedicide – for weeds

**ENDNOTES**

<sup>1</sup>Andromeda, Natividad. Effects of Pesticide as Hazards on Farmers of Selected Areas of La Trinidad, Benguet. (unpublished thesis), p.36

<sup>2</sup> Agnes C. Rola, Prabhu L. Pingali. Pesticide Productivity, and Farmers's Health, an economic assessment. (manila: International Rice Research Institute; 1993), p.57

<sup>3</sup> Ibid.

## CHAPTER II

### REVIEW OF RELATED LITERATURE

Man is surrounded by enemies: he is fighting constantly against weeds, insects, plant diseases and rodents.

Until the middle of the 19<sup>th</sup> century, man was helpless against the mass attack of insects.

Many forms of combat are used in the warfare against pest: sanitation, building devices, plant breeding, natural control by growing beneficial insects and of course chemicals. All these methods have value, but for immediate protection in many fields, dependence must first be placed in the use of chemicals.

To be effective as a control agent, the chemical must first of all be toxic. Only after many years was it recognized that the chemical itself must also be one that could be used without being harmful to man.

#### **Pesticides**

Pesticides are chemicals used to kill or control pest that damage the crop or cause disease to crops. They are classified by the type of pest they control: a) insecticides (insects) b) herbicides (weeds) c) fungicide (Fungus) d) rodenticide (rodents) e) nematocide (nematodes) f) Acaricide (ticks, mites and spiders)

Some pesticides also are classified according to their mode of application (fumigant) or mode action (ovicide).

It also include substances for use as a plant growth regulator, defoliant, desiccant, fruit thinning, an agent to stop premature fruit-fall or a substance applied to protect commodities from destruction during storage and harvest.

There are 5 classes of pesticides that are used world wide today. These are Organochlorides, Organophosphates, Carbamates, Dipyridyls and Chlorophenoxy compounds.

Organochlorides are chemicals that interfere with axonic transmission of nerve impulse disrupting the central nervous system functions. Some of these include Endrin, Lindane, DDT, Hiptador, Chlordane, Aldrin and Toxaphene. These chemicals when absorbed circulates throughout the body, detoxification and excretion are slow and incomplete. They are stored mainly and highly toxic in the liver, kidneys and fat tissues.

Organophosphates almost irreversibly vary the amounts of acetylcholinesterase enzymes of the tissue allowing accumulation of acetylcholine at the cholinergic neuroeffector junctions (muscarinic effect). Examples are Parathion, Malathion, and Diazinon phosphate.

Carbamates allow the accumulation of acetylcholine at the cholinergic, at the skeletal muscle, myoneural junction and in autonomic ganglia (nicotine effect). Examples are Carbaryl, Selvin Proxoxur Landrin. These chemicals cause systemic damage and impair the central nervous system.

Dipyridyl are used as herbicides that could injure the epithelial tissues of the skin, eyes, and mouth, respiratory and gastrointestinal tract and at times causes necroses and ulceration of the mucosal lining. It is extremely toxic. Earth to humans has been reported from as little as 43 mg/Kg.

Chlorophenoxy includes Dioxyn which is the most toxic and carcinogenic in the human made compounds causing cancer. It is irritating to the eyes, skin, respiratory and gastrointestinal tract.

**Mode of Action by which Pest is affected by Pesticide:**

A. Pesticide:

1. Fumigants: Volatile. They enter the body through the respiratory system
2. Contact poison: They enter the body by reason of contact with treated surfaces like the plant foliage.
3. System poisons: These are absorbed by the plants through the leaves, stems, fruits or roots and through the plants, vascular system to its other parts. By feeding upon the treated plants, insects acquire the poisons.
4. Physical poison: These kill the insects by suffocating them or by disrupting the cuticles.
5. Stomach Poison: They are usually eaten by the pest and absorbed into the body through the digestive tract.

B. Herbicides:

1. Contact herbicides: These kills only a part of the plant of which they come into direct contact with.
2. Systemic herbicides: Leaves or roots absorbed and translocate them within the plants top other tissues.

C. Fungicide:

1. Protectants: these are for application to plants before infection to prevent development of the disease

2. Eradicants: Applied to destroy diseases already existing into the plants.

D. Rodenticides:

1. Acute poison: Highly toxic to rodents. After ingestion they are rapidly killed

2. Chronic poison: They cause the rodents to die of widespread bleeding.

### **Toxicity**

Toxicity of pesticide denotes poisonous it is. The World Health Organization has classified pesticides according to hazards or degree of toxicity it contains. Pesticides are grouped into three categories: Extremely Hazardous, Moderately Hazardous and Slightly Hazardous

Ld 50 (lethal dose) is used to denote the acute toxicity of a pesticide. It is referred to as the average dosage in milligrams of a particular pesticide per kilogram of body weight (mg/Kg) that is needed to kill 50% of the experiment.<sup>1</sup> The lower the LD 50 value, the more toxic is a particular pesticide.<sup>2</sup>

#### GUIDELINE for LD 50 VALUES in RELATION to TOXICITY to HUMANS

TOXICITY RATING	ORAL LD 50 (mg/Kg)	AMOUNT that will KILL an AVERAGE ADULT
Super toxic	Less than 5	A few drops
Extremely toxic	5- 50	Up to teaspoon
Highly toxic	5- 500	Teaspoon up to 2 table spoon
Moderate toxic	500- 5000	1 ounce up to 12 ounces
Slightly toxic	5000- 15000	12 ounces to half gallon

These are two kinds of toxicity: an acute toxicity and chronic toxicity, acute toxicity would include the poisonous effect which appears immediately or soon after exposure.

Chronic toxicity is a toxicity in which poisonous effect appears after months or years of conditions or repeated exposure.

### **Pesticides route of entry through Alimentary Tract:**

When the pesticide are taken directly into the mouth and swallowed, they enter the body from the stomach and intestines. While most people would not intentionally eat or drink a pesticide, they may do so by:<sup>3</sup>

- a. Consuming food or drink that has been contaminated by spills of pesticide or by being stored near pesticide.
- b. Consuming food and drinks that has been prepared or stored in empty pesticide containers.
- c. Handling and eating food and drinks with hands that are contaminated with pesticide
- d. Smoking with contaminated hands; and
- e. Touching the mouth with contaminated hands.

### **Health Risk to Man**

The farmers and the immediate members of their families are contentiously exposed to the hazards of pesticide use. Pesticide deaths are estimated at 4 rice farmers in the Philippines.<sup>4</sup> A study has also shown that pesticides are being used by Benguet people as a means to commit suicide.<sup>5</sup> At least forty five (45) cases of suicide using pesticide are reported every month.

Pesticides enter the human body by three possible ways: orally, through the mouth; through the skin by absorption; and inhalation via the nose and to the lungs.<sup>6</sup>

It was also observed that women who have been handling pesticides for more than 10 years have children aged 2 who are unable to stand and walk and other neurological problems.

The consumers are also at risk due to the use and overuse of pesticides including the banned chemicals such as the “white powder” or cyanide. On October 28, 1994, it was reported also that a certain pesticide could cause sterility to the farmers due to over exposure.<sup>7</sup> (Refer to Appendix A for the list of pesticide brand/manner of preparation/frequency of use among vegetable farmers and Appendix B for the list of pesticides currently sold in the various agricultural stores in Baguio and Benguet)

**END NOTES**

<sup>1</sup> Charles E. Cheng, Katherine V. Bersamira. Pesticides: Its Hazardous Effects on Benguet Farmers and the Environment. (Baguio City: Unique Printing Press; 1994), pp.92-93.

<sup>2</sup>Ibid. p.93.

<sup>3</sup>Ibid. p.129.

<sup>4</sup>Ibid. p.21.

<sup>5</sup>Ibid. p.77.

<sup>6</sup>Ibid. p.21.

<sup>7</sup> Carolyn O. Argillas. Governor Seeks Probe of Pesticides. (Philippine Daily Inquirer; 1994)

<sup>8</sup> Cheng, Bersamira. Opcit. P.61.

<sup>9</sup> Ibid. pp. 66-68.

## **CHAPTER III**

### **METHODS AND PROCEDURES**

#### **Research Design and Methodology**

This study made use of the descriptive survey as a method of investigation in gathering groups of classified, generalized, analyzed and interpreted data. In this study, the incidence of gastrointestinal disorder and its relationship to pesticide exposure were determined based on descriptive survey.

The subjects of this study were the farmers of barangays Central, Datakan, Labueg and Paykek in the town of Kapangan, Benguet. The sample that represents the four barangays were chosen by random sampling in which 20 out of total population of each barangays were chosen as subjects for interview, although not all of them are spraying pesticide in their garden. Only 19 in Central, 19 in Datakan, 18 in Labueg and 17 in Paykek were actually doing the work of spraying pesticide in their garden.

#### **Source of Data**

Data relevant to this study was obtained from the written responses of farmers from the four selected barangays of Kapangan, Benguet to the interview questionnaires utilized. The lists of relevant questions lifted from the BSU-SLU VLIR interview questionnaire is presented in Appendix N.

Information was also obtained from the study entitled Pesticides: Its Hazardous Effects on Benguet Farmers and the Environment by Charles E. Cheng and Katherine V. Bersamira. This literature provided a guide to this study and to the researchers.

### **Data Gathering Tools**

BSU-SLU VLIR interview questionnaire was purposively used in this study as the data gathering tool.

The interview questionnaire asked questions pertaining to symptoms of gastrointestinal disorder and other questions essential in answering the other specific problems in this study. Each farmer with the guidance of the researchers answered the questionnaires. After the questionnaires had been answered, responses by each farmer to selected 15 questions were recorded, analyzed, and studied. The 15 questions were the important variables used in this study (see Appendix N).

### **Analysis of Data**

The incidence of gastrointestinal disorders was presented as low, moderate, and high. Part of the questionnaire focuses on symptoms of gastrointestinal pathology. The total number of symptoms presented by the farmers in a barangay was divided by the corresponding total number of respondent farmers in that barangay to get the mean incidence of gastrointestinal disorders of which was evaluated using the following statistical limits and descriptive equivalent:

POINTED VALUE	STATISTICAL LIMITS (Mean Incidence of Gastrointestinal Symptoms)	DESCRIPTIVE EQUIVALENTS
3	2.35- 3.00	High
2	1.68- 2.34	Moderate
1	1.00- 1.67	Low

To determine the average weighted mean of the incidence of gastrointestinal disorders among the respondent farmers from the selected four barangays of Kapangan, Benguet, the following formula will be used:

$$WM = \frac{TWM}{n}$$

where: WM = Weighted Mean  
 TWM= Total Weighed Mean (sum of the mean incidences of gastrointestinal symptoms among the respondents in the four barangays)  
 n = Total Number of cases

The distribution of farmers exhibiting at least one symptom of gastrointestinal disorder in the four barangays was presented in a pie graph and the difference between the mean incidences of symptoms of gastrointestinal disorder between each barangay was treated with F-test. The correlations of the number of gastrointestinal symptoms to age of those pesticide users and to hours of pesticide application per day were represented in a scatter diagram.

Incidence of symptoms of gastrointestinal disorders as to gender (between males and females) and as to manner of pesticide application (between those who spray against the wind or not; between those who eat and who do not eat while applying pesticide; and between those who apply pesticide with or without the use of protective clothing) were compared through t-test. In the comparison of the incidence of gastrointestinal symptoms between farmers using only insecticide, a farmer using only fungicide, farmers using only

weedicide, farmers using any two of the three kinds of pesticide and farmers using all the three kinds of pesticide, the F-test was used.

## CHAPTER V

### SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter deals with a brief summary of findings previously discussed in Chapter IV. A conclusion which is an overview of the entire study was also included. Finally, recommendations were made based on the findings and conclusions.

#### SUMMARY

Four barangays of Kapangan, Benguet namely Central, Datakan, Labueg, and Paykek were selected by the researchers to be the locale of the study. All of the four barangays are mainly consists of agricultural lands. Farmers in each barangay were selected as respondents for interview. The selected subjects in the four barangays fell under the age range of 20 to 78 years old. There were 19 respondents from Central, 19 also from Datakan, 18 from Labueg, and 17 from Paykek. BSU-SLU VLIR interview questionnaires were utilized to gather data such as the symptoms of gastrointestinal disorders experienced by each farmer including the gender, age, frequency of pesticide application, kinds of pesticide used, and the manner of pesticide application.

The incidence of gastrointestinal disorders in each barangay was presented descriptively as low, moderate and high based on previously set statistical limits. The weighted mean incidence of gastrointestinal disorders in each barangay was computed, and the computed weighted mean may fall to either three statistical limits with their corresponding interpretation as low, moderate or high.

In comparing incidence of gastrointestinal disorder per barangay, the significant differences between the mean incidences of gastrointestinal symptom among the four

selected barangays were tested using F-test. The distribution of the farmers manifesting symptoms of gastrointestinal disorders among the four selected barangays was shown in a pie graph. F-test was also used to determine whether there was a significant difference in the mean incidences of gastrointestinal disorders between farmers using different kinds of pesticide.

T-test was employed to compare the mean incidence of gastrointestinal symptoms between farmers who apply pesticide against the wind and those who do not apply against the wind; to compare the mean incidence of gastrointestinal symptoms between farmers who eat while spraying and those who do not eat while spraying; and to compare the mean incidence of gastrointestinal symptoms between farmers who use protective clothing and those who do not use during pesticide application.

Correlations of the incidence of symptoms of gastrointestinal disorders to age and to the frequency of pesticide application (in terms of hours per day) were determined by computing the Pearson Product Moment Correlation Coefficient. The computed Pearson Product Moment Correlation Coefficients were interpreted and the analyses made were illustrated in a scatter diagram.

## **CONCLUSIONS**

Based on the findings the following conclusions were made by the researchers:

1. a) The symptoms of gastrointestinal disorders prevail among the farmers with at least one gastrointestinal symptom.
- b.) The variation in the mean incidence of symptoms of gastrointestinal disorders among farmers using any kind of pesticide is not significant.

2. a.) Regardless of whether farmers applied pesticide against or not against the wind, incidence of symptoms of gastrointestinal disorders is manifested.
  - b.) Regardless of whether farmers eat or do not eat during pesticide application, incidence of symptoms of gastrointestinal disorders is manifested.
  - c.) The use of protective clothing significantly decreases the incidence of gastrointestinal symptoms.
3. Age, gender, and daily hours of pesticide exposure are not predisposing factors in the possible manifestation of gastrointestinal symptoms.

## **RECOMMENDATIONS**

Based on the findings and conclusions, the following are recommended:

### A. For the farmers

1. They should practice wearing of protective gadgets such as masks, goggles, gloves, pants, long sleeves, hat and boots during pesticide application to lessen gastrointestinal disorders related to pesticide.
2. Apply pesticide in a proper duration of time.
3. Avoid eating during pesticide application.
4. Avoid spraying during the time of the day when the surrounding is windy.
5. Have a routine medical consultation for the detection of the presence of abnormalities not well manifested by sign and symptoms.

B. For the future researchers

1. Biochemical examinations of stool samples from farmers to diagnose any condition associated with gastrointestinal disorders.
2. Classify symptoms as to what kind of gastrointestinal disorder it belongs.
3. Comparison of the incidence of gastrointestinal disorders if any, among farmers using different kinds of pesticide considering the color code of pesticides as shown in Appendix B.
4. Use of greater number of subjects and a wider scope of locality for study.

C. For the Agricultural Sectors of the Government

1. Conduct a seminar workshop in every barangay to educate farmers of the proper use of pesticides with regards to when is the proper time to apply a certain kind of pesticide with the proper manner of preparation, application and amount to be used.
2. Following up the farmers' performance to check whether they are doing the proper way of pesticide preparation and application.

D. For the Health Sectors

1. Conduct medical examination for farmers.
2. Conduct a seminar workshop to educate farmers regarding the effects of pesticides on health.

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