สำนักงานวิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

CHAPTER II

LITERATURE REVIEW

2.1 PESTICIDE

Pesticide has used in environment is appear to be it is higher in the developing countries than used in the developed countries. In developed countries, the aim of using the pesticides was make sure to be safe and has minimum hazard to human and also in the environment is certified by the suitable technique, infrastructure, regulation and economic support.

In Sri Lanka, a pesticide is also used in the agriculture. The people can buy pesticide from local food shops and they have low prices (Van der Hoek et al., 1998). This condition is seemed to be in many developing countries. The pesticides has used very quick and they are increasing over the years. Pesticides are extensively used across the world. In spite of their widespread use that has existed for a long time for public goods, organophosphate (OP) and carbomate insecticides have caused several harmful effects on the health of humans. In this connection, environmental exposure to Ops along with detrimental reproductive consequences in men and women working on or living in the proximity of farms are more and more reported all over the world. (Roshini et al., 2007)

Thailand has been importance pesticides including herbicide, insecticide, and fungicide since the 1950s coinciding with the expansion of the country's agricultural system from domestic to industrial production and mono-cropping agriculture. In 2008, we were found that most patients with toxic chemicals from pesticides and the poisoning for getting with diseases of chemicals from occupations across the country totaling 2,141 persons and the most of them are farmers.

"The International Code of Conduct on the Distribution and Use of Pesticides of the Food and Agriculture Organization (FAO)" of the United Nations has tried to analyze of pesticide that has using and poisoning in Central America around 20 years. So they had met that was estimated that maybe the registration decisions are based on such data. The widely use of very dangerous pesticides continues in Central America and risk from poisonings with "organophosphates, carbamates, endosulfan and paraquat" as the main causative agents (Food and Agriculture Organization of the United (FAO), 1990)

However, international regulatory directive are important in developing countries, and international agencies should strongly extend its scope and influence, limiting industry involvement. Profound changes in international and national agricultural policies, steering towards sustainable agriculture based on non-chemical pest management, are the only way to reduce poisonings.

2.2 Effect of pesticide

Organophosphate (OP) and Carbamate insecticides form are the groups of chemicals that are primarily used in agriculture. The conditions of exposure to organophosphate and carbamate insecticides at high degree along with the accompanying health risks in developing countries of the globe are famous. OP pesticides, for example Malathion, Parathion, Phosalone, Fenitrothion, Dichlorvos, and Chlorpyrifos are rapidly decomposed and these components are somewhat non persistent in the environment. They are described as being highly acutely toxic. Organophosphate and carbamate insecticides produce an effect on the nervous system by causing disorder in the enzyme which controls acetylcholine, a neurotransmitter. An unspecified number of them are very toxic. Organophosphate and carbamate insecticides have the highest morbidity rate of poisioning among the farmer (US EPA, 2012).

Despite their extensive and longstanding use for the public well, organophosphate (OPs) pesticides have direct to several adverse effects on human

health. Environmental exposure to OPs and damaging on reproductive outcomes in men and women who are working on or are staying near farms are increasingly reported worldwide.

Low-level exposure effects are studied in occupationally or environmentally exposed groups, who are exposed to levels of Ops that basically do not plain in overt clinical features of acute OP poisoning as described in the medical literature. There are many reports on the "adverse health impacts of occupational exposure to OPs." That was studies on health effects of low-level exposure to OPs have documented self-reported symptoms, effects on the nervous system and the respiratory system (Roshini et al., 2007).

Occupational exposure to pesticides has been found to have damaging effects on the female reproduction system, for example "menstrual cycle disturbances", "reduced fertility", "prolonged time-to-pregnancy", "spontaneous abortion", "stillbirths" and "developmental defects". The pre-menopausal women who were associated in mixing/applying pesticides, not limited to OPs, longer menstrual cycles and extended odds of missed periods and inter-menstrual bleeding were found compared with women who were never exposed to pesticides. Exposure of experimental animals to OPs has shown a significant reduction in brain with "acetylcholinesterase activity", "LH" and "progesterone levels and egg production". They have shown that OP is a competitive androgen receptor antagonist comparable in potency to the pharmaceutical antiandrogen flutamide.

However, some of researchers report a few or no association between OP exposure and damaging health effects such as "miscarriage", "pre-term delivery", "small-for-gestational-age births and sex ratios", and "congenital malformations such as nervous system defects", "cardiovascular defects", "oral clefts", "hypospadias or epispadias", "musculoskeletal defects" and "non-specific anomalies".

Organophosphate and carbamate insecticides produce an effect on the nervous system by causing disorder in the enzyme which controls acetylcholine, a neurotransmitter. An unspecified number of them are very toxic. They were grown

gradually during the early 19th century. But the discovery of their effects on insects that resemble the ones on humans took place in 1932. An unspecified number of them are very toxic (US EPA, 2012).

Table 2.1 Signs and symptoms related to Organophosphates and carbamate exposure.

Manifestations	Exposure	Signs and symptoms
Central nervous system	Mild	Headache, confusion, drowsiness, dizziness
	Moderate	Blurred vision, slurred speech, ataxia
	Severe	Convulsions, coma, heart block
Cardiovascular system	Moderate	Bradycardia
Gastrointestinal system	Mild	Anorexia
	Moderate	Nausea, vomiting, abdominal cramps
	Severe	Diarrhea, fecal incontinence
Respiratory system	Mild	Wheezing, dyspnea
	Moderate	Bronchorrhea, bronchospasm
	Severe	Cyanosis, pulmonary edema
Urinary system	Severe	Loss of urinary control
Glands	Mild	Hypersalivation, hyperlacrimation, sweating
Pupils	Mild	Miosis,
	Severe	Pinpoint, unreactive to light

Source: US EPA (1999)

2.3 Biomarkers

Biological monitoring is an instrument for the measurement of pesticide exposure level that enters the body. It can evaluate human exposures to both environment and work pace. In case where exposure changes irregularly eventually, and or the skin is a meaningful path of absorption, biological monitoring has proved to obtain the absorbed dose information. The measurements of biological monitoring are used in blood, urine, saliva, or breast milk as biological media by the estimate of the amount of pesticide as its metabolite or its reaction product which is absorbed into the body (IPCS, 2000).

Therefore, it is impossible to specify to which specific organophosphate a person was exposed on the basis of the detection or quantification of dialkylphosphate metabolites in the urine. The studies not long ago have measured the quantity of biomarkers of exposure to organophosphates in vast samples of the United States population, by the use of urinary dialkylphosphate as well as other metabolites. Whereas this research offers significant information on exposure to organophosphate insecticides and their metabolites in the population, in general accepted guidelines related to the interpretation of these biomarkers of exposure have not been created. The discovery of urinary alkylphosphates in the urine does not essentially show that they cause a harmful effect on health. There has been no study on correlation between urinary dialkylphosphates and acetylcholinesterase enzyme activity in the general population. Further research is required for the determination of links between these biomarkers of exposure and health effects and comparative role of dietary, residential, and occupational ways of exposure.

Moreover, the interpretation of urinary dialkylphosphates is not simple because the hydrolysis of a particular organo-phosphate may produce more than one class of dialkylphosphates. This is obvious in the case of chlorpyrifos, where the products of hydrolysis can involve both diethylphosphate (DEP) and diethylthiophosphate, being dependent on whether the chlorpyrifos has experienced metabolic activation to chlorpyrifos-oxon in the body.

Red blood cell AChE (acetylcholinesterase) and plasma PChE (plasma cholinesterase) can be used as sensitive biomarkers to detect exposure to OP and carbamate nerve agents, pesticides, and cholinergic drugs in humans and animals. We should to collected the samples on 24 hours after the end of their exposure because they had lower AChE activities (Mason, 2000).

2.4 Test Kit Cholinesterase Measurements

Test-mate ChE Cholinesterase Test System (Model 400) refers to the mobile instrument for the quantitative determination of cholinesterase in whole blood to monitor pesticide exposure (EQM Research, Inc., 2003).

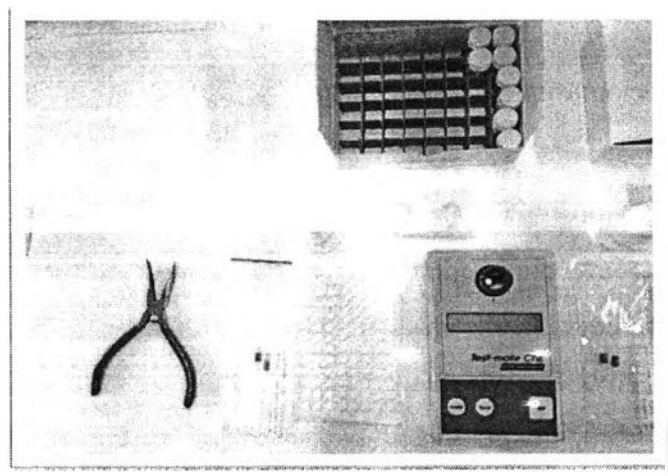

Figure 2.1 Test-mate ChE (Model 400)

The Test-mate ChE is useful for surveying occupational exposure to pesticides. There is the significant of the measurement on a ordinary basis of levels cholinesterase in blood of workers involved in handling pesticides, these workers are likely to be protected from excessive exposure to pesticides prior to the appearance of symptoms. Moreover, it is possible to evaluate pesticide handling safety programs for

effectiveness as well as compliance, resulting in the improved protection of workers in the long term.

The Test-mate ChE is a test of cholinesterase testing system. The equipment and reagents in total that are required for performing 96 tests fit easily within the storage case. Only 10μL is required by system for each blood test that is likely to be obtained with ease from a fingerstick sample. The whole assay may be finished in less than 4 minutes, making the quick evaluation of poisoning status easy. They are measuring quickly than the measurements performed in the clinic (EQM Research, Inc., 2003).

The reaction of Cholinesterase in the EQM Test-mate

$$\text{thiocholine ester (AcTC/BuTC)} \xrightarrow{\textit{Cholinesterase}} \text{thiocholine}$$

$$\text{thiocholine} + \text{DTNB} \longrightarrow \text{TNB-thiocholine} + \text{TNB (}\textit{yellow}\text{)}$$

The Test-mate ChE Cholinesterase Test System is on the basis of Ellman method. Acetylthiocholine (AcTC) or butyrylthiocholine (BuTC) is hydrolyzed by AChE or PChE, respectively, producing carboxylic acid and thiocholine with reaction to the Ellman reagent (DTNB, dithionitrobenzoic acid) so as to create a yellow color that is gauged spectrophotometrically at 450 nm. The rate of color formation is in proportion to the amount of either AChE or PChE (EQM Research, Inc., 2003).

2.5Pesticides exposure

Three ways for pesticides exposed to people: Getting pesticides in their month or digestive tract (oral exposure). Inhaling pesticides (inhalation exposure), Absorbing pesticides through the skin (dermal exposure). Depending on the situation, pesticides could enter the body by any one or all of these routes. Typical sources of pesticide exposure include: food, Home and Personal Use Pesticides, Pesticides in Drinking Water, and Worker Exposure to Pesticides (US EPA, 2007).

Food refers to most of the foods we eat have been grown with the use of pesticides. Therefore, pesticide residues may be present inside or on the surfaces of these foods.

Home and Personal Use Pesticides refer to you might use pesticides in and around your home to control insects, weeds, mold, mildew, bacteria, lawn and garden pests and to protect your pets from pests such as fleas. Pesticides may also be used as insect repellants which are directly applied to the skin or clothing.

Pesticides in Drinking Water refer to some pesticides that are applied to farmland or other land structures can make their way in small amounts to the ground water or surface water systems that feed drinking water supplies.

Worker Exposure to Pesticides refers to Pesticide applicators, vegetable and fruit pickers and others who work around pesticides can be exposed due to the nature of their jobs. To address the unique risks workers face from occupational exposure, EPA evaluates occupational exposure through a separate program. All pesticides registered by EPA have been shown to be safe when used properly (US EPA, 2007).

2.6 Knowledge, Attitude and Practices (KAP)

The study on KAP assesses Knowledge, Attitude and Practices of a community. It serves for an educational analysis of the community. This KAP study aims mainly to explore transformations in Knowledge, Attitude as well as Practices of the community, paramedical staff and medical practitioners regarding diabetes and diabetic retinopathy. The present research will provide information for appraisal of the diabetic retinopathy program. It discloses increases in knowledge, changes in attitudes towards diabetes and diabetic retinopathy together with changes in the sorts of practices that are complied with concerning diabetes and diabetic retinopathy management (Kaliyaperumal, 2004).

Prior to the start of the process to create awareness in any specified community, in the first instance, it is essential to evaluate the environment in which

awareness creation will emerge. Can the undertaking of KAP study best do this task? KAP study informs us of the people's knowledge about some particular things, their feelings and behaviors as well. KAP study measures three topics including Knowledge, Attitude and Practice. (WHO, 2008)

The knowledge owned by community members in this case means their understanding of any stated topic that is concerned with diabetes and diabetic retinopathy. Attitude is relevant to their feelings towards this subject and any preconceptions that they may have towards it. Practice refers to the methods in which they display their knowledge and attitude through their actions. Increasingly efficient process of awareness creation will be possible by means of understanding the levels of Knowledge, Attitude and Practice because it will allow the program to be suited with more appropriateness for the requirements of the community (Kaliyaperumal, 2004).

In view of assessing the KAP of a community, it is useful to separate such community into sub-categories with smaller scale. In this regard, these groups can be defines as the Medical Community and the General Community. The first one comprises those with responsibility for providing medical care to the population. Such group includes doctors, paramedical staff, pharmaceutical providers as well as others.

It is possible to further divide the said category into Medical Practitioners and Paramedical Personnel in areas with a large sufficiently population of these two groups. The General Community includes people who receive medical care. Several reasons exist to anticipate that the levels of KAP will differ in these two categories. This fact should be remembered when awareness creation programs are developed gradually for these two categories to achieve the maximal extent of efficiency (Kaliyaperumal, 2004).