

REPORT ON BLOOD CHOLINESTERASE AMONG VEGETABLE GROWERS

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Abstract. We report our study on serum cholinesterase in vegetable growers, a risk occupation in a rural area of Thailand. In this study, 70 subjects (35 vegetable growers and 35 controls) were studied. The mean blood cholinesterase level in vegetable growers (17.7±7.0 U/ml) was significantly lower than that of the control group (24.7±12.4 U/ml) (p=0.01).

INTRODUCTION

Pesticides are widely used chemical substances in the present day. The banning or restricted use of persistent organochlorine pesticides has resulted in the increased use of organophosphate pesticides. In general, these substances are less persistent in the environment than the organochlorine pesticides but are more likely to poison the people who use them or come into contact with them (Ciesielski *et al.*, 1994).

Organophosphate pesticides are powerful inhibitors of cholinesterase, the enzyme responsible for the metabolism of acetylcholine, the neurotransmitter at the parasympathetic and myoneural junctions, in autonomic ganglia, and in the brain. Hence, workers who apply and mix pesticides are at special risk of systemic pesticide illness. Poisoning occurs when the inhibition of cholinesterase leads to the accumulation of acetylcholine at the nerve synapses, resulting initially in over-stimulation and then paralysis of neural transmission (Ciesielski *et al.*, 1994). Both acute and chronic exposure can occur during daily work.

Based on the concept of occupational medicine, the use of biological monitoring has been

found to be valuable. Measurement of serum cholinesterase is a quick screening test indicated for cases with a history of possible exposure to organophosphate compounds (Hayes *et al.*, 1980; Coye *et al.*, 1986).

Thailand being an agricultural country, a number of occupations may be at risk of exposure to pesticides. Here, we report our study on serum cholinesterase in vegetable growers, a risk occupation in a rural area of Thailand.

MATERIALS AND METHODS

Subjects

A total of 70 male subjects were included in this study. The first group, comprising the study group of 35 subjects, was a group of vegetable growers in a rural community in Chiang Mai Province, Thailand. The second group, 35 subjects, was the control group with low risk of acetylcholine exposure during their daily occupational work, and who resided in downtown Bangkok. Serum samples from all subjects were collected for laboratory analysis between midday.

Laboratory analysis

All samples collected were sent to the laboratory for analysis of serum cholinesterase level. Determination of serum cholinesterase level was performed using the method described by Biggs *et al.* (1958). All analyses in this study were performed at room temperature

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according to the standard quality control.

Statistical analysis

Mean and standard deviations of cholinesterase levels in both groups were calculated. The average serum cholinesterase levels of each group were compared using the unpaired two tailed *t*-test with the level $p \leq 0.05$ considered statistically significant.

RESULTS

The scatterplot of blood cholinesterase in each group is presented in Fig 1. The mean blood cholinesterase level in the vegetable growers was 17.7 ± 7.0 U/ml. The mean blood cholinesterase level in the controls was 24.7 ± 12.4 U/ml. The mean blood cholinesterase level in the vegetable growers was significantly lower than the control group ($p=0.01$).

DISCUSSION

Cholinesterases constitute a group of esterases that hydrolyze choline esters at a higher rate than other esters. Plasma cholinesterase is measured to diagnose organophosphate toxicity. It is a good and easy-to-perform biomarker for measuring both acute toxicity and chronic exposure. Measurement of cholinesterase can be a good indicator in assessing the effectiveness of protective behaviors, as well as a measure of worker compliance with safety procedures (Coye *et al*, 1986; Hayes *et al*, 1980).

There are few reports focusing on monitoring exposure to pesticides among the Thai. Here, we present the results of a study in a sample of Thai vegetable growers. Growers can be representative of other similar agriculture related occupations, which is the major group of occupations in Thailand. The workers in these occupations appear to have less opportunity of getting health protection equipment and knowledge than workers in industrial occupations.

Measurement of cholinesterase levels in blood is a well-established method of detecting organophosphate pesticide exposure. Following exposure, the level of cholinesterase ac-

Table 1
Plasma cholinesterase levels in vegetable growers and control group.

Group	Number	Plasma cholinesterase level (U/ml)	
		Range	Average
Control group	35	10-59	24.7 ± 12.4
Vegetable growers	35	8-3.8	17.7 ± 7.0

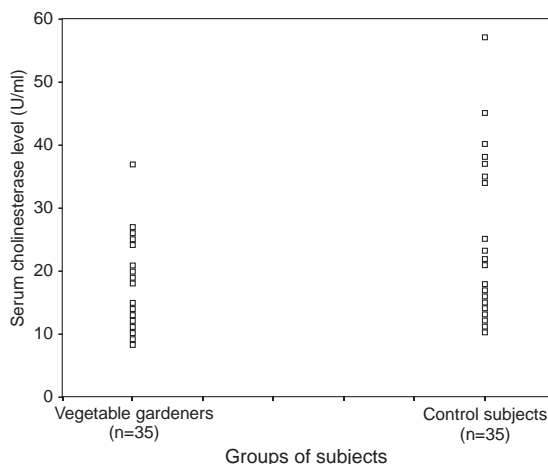


Fig 1—Scatterplot of blood cholinesterase in each group.

tivity decreases, which can be measured. Our study found a significantly lower level of serum cholinesterase among the vegetable growers, compared with the control group. This reflects the average higher exposure of these growers to pesticides during their daily live. It can also reflect the lack of proper preventive management of these subjects. Therefore, specific concerns for agriculture-related workers and their risk behaviors in exposure to pesticides are necessary (Davies *et al*, 1982). Routine check-ups, including follow-up on plasma cholinesterase for these workers, is recommended.

Some limitations of this study should be noted. In this study, we compared directly the serum cholinesterase levels between exposed and non-exposed subjects. However, to detect such a decrease in a risk subject, a baseline activity measurement prior to exposure and

follow-up measurement are necessary. This is not always possible in practise. Nevertheless, cholinesterase measurement is affected by gender (Sanz *et al*, 1991), which must be considered in any study. To obviate this problem, this study used only male subjects. Other new biomarkers in exposure risk monitoring for pesticides should also be further evaluated.

ACKNOWLEDGEMENTS

The author is thankful to Dr Akkaradej Suyaphan, who helped in specimens collection; Nirattana Pathompattama and Roongnapa Tarwananootikool, who performed the laboratory analysis in this study.

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