CHAPTER 4

CONCLUSION

4.1 Conclusion of research section 1:

Distribution of POPs in the environment

p,p'-DDT was detected in all samples and had the highest level. The second highest level was that for *p,p'*-DDD, followed by *p,p'*-DDE. It can be hypothesized that this population has recently exposed to DDT because *p,p'*-DDT levels were higher than *p,p'*-DDD and *p,p'*-DDE levels. The insecticide DDT was probably illegally used in the study site in spite of its banned.

4.2 Conclusion of research section 2:

Effect of POPs on reproductive hormone levels in adult men

4.2.1 *p,p'*-DDE and *p,p'*-DDT were detected in all subjects of the studied population and had the highest level. The second highest level was that for *p,p'*-DDT, followed by *p,p'*-DDD.

4.2.2 Durations of environmental exposure and DDT use for farming in the past were determinants of DDT levels in adult men. DDT residues detected in adult men were likely due to environmental and occupational exposures.

4.2.3 Plasma E_2 levels were negatively associated with plasma *p,p'*-DDE levels, but positively associated with plasma *o,p'*-DDE levels. The opposite direction of the associations for *p,p'*-DDE and *o,p'*-DDE may reflect their different mechanisms of hormonal activities.

4.2.4 Levels of DDT in the biological fluids might be an important factor affecting hormonal status in men. Plasma levels of DDT might not be high enough to compete completely at hormone receptor level, or to affect hormonal metabolism and transport. In addition, low levels of exposure might be compensated by normal homeostatic mechanisms and therefore resulted in a small or an insignificant hormonal response.

4.2.5 No association was found between POPs and estrogenic activities of chemicals in adult male plasma. It is likely that the studied population might have been exposed to other estrogenic chemicals, i.e. other pesticide groups used in agriculture.

4.3 Conclusion of research section 3:

Effect of POPs on reproductive and thyroid hormone levels in infants

4.3.1 *p,p'*-DDE was detected in all subjects of the studied population and had the highest level in both Districts. The second highest level was that for *p,p'*-DDT, followed by *p,p'*-DDD, which is the same pattern occurred in adult men.

4.3.2 A high correlation coefficient was found for *p,p'*-DDE, *p,p'*-DDT, and *p,p'*-DDD in both Mae Rim and Chiang Dao Districts. It can be concluded that placental transfer of these three compounds reaches a balanced state between mother and fetus.

4.3.3 Cord serum TT_4 levels were negatively associated with cord serum levels of *p,p'*-DDE, *p,p'*-DDT, and *o,p'*-DDE. It can be concluded that exposure to DDT and its metabolites during fetus development may induce some effects on thyroid hormonal status in infants

4.3.4 TT_4 levels of most subjects (92.3%) were within the normal range. It is possible that serum DDT levels might not be high enough to have an obvious effect on hormonal metabolism.

4.3.5 *p,p'*-DDE levels were positively associated with estrogenic activities of chemicals in cord serum, however, correlation coefficient of the association was rather weak. It is possible that the studied population might have been exposed to other estrogenic chemicals contaminated in the areas.

4.4 Suggestions for further investigation

The present research was likely to be the first study conducted in Thailand, and the studied population was pilot. Therefore, further investigation needs to study POP levels and their adverse health effects in highly exposed population.

Although low levels of POP exposure in adult men may produce a small or an insignificant hormonal response, exposure at these levels may result in other adverse reproductive effects, such as decreased sperm counts, reproductive tract abnormalities, infertilities, and reproductive cancers. Therefore, the effects on adverse reproductive outcomes should be investigated in the highly POP contaminated area.

Thyroid hormones play an important role in brain and neurodevelopment of infants. Therefore, the small change of hormonal levels may cause irreversible changes during development and affect later functioning in adult life. This finding emphasizes the need to further investigate the adverse effects on thyroid hormones, growth, and neurodevelopment in children from highly POP contaminated area.

Currently, numbers of chemicals are known as or suspected to be EDCs. Pyrethroid pesticides, including permethrin, cypermethrin, and deltamethrin, are also suspected to be EDCs. These chemicals have been extensively used in farming activities and malaria control programs in northern Thailand. They have been applied for controlling mosquitoes since DDT was banned for malaria control programs. Therefore, pyrethroid levels and their adverse health effects should be investigated.

ELRA has been developed in Prof. Dr. Bertold Hock's laboratory, Technical University of Munich, Germany, and successfully employed to study xeno-estrogens. The advantages of this assay are easy to perform, rapid, and relatively inexpensive. Therefore, the further research needs to transfer this technique to Thailand for detecting xeno-estrogens in foods and other environmental samples, and to monitor xeno-estrogens in agricultural water resources.