

I. INTRODUCTION

1.1 Background

Indonesia which has a tropical climate is one of the areas with so many cases of disease caused by mosquitoes since the tropical climate is a suitable condition for mosquitoes to breed. Most people affected by mosquito-borne diseases are part of low-income communities due to inadequate environmental hygiene. The low-income condition had led the communities to use mosquito coils to control the mosquito populations because they are cheap and readily available. The product contains insecticides of several chemical compounds. Several repellent products are also available to control other pests such as flies. Insecticides are a class of pesticides, where pesticides are part of a toxic substance that can kill insects (Ahmadin *et al.*, 2015).

Concern about diseases with mosquito vectors has led many communities in Indonesia to use mosquito coils because they are easy to obtain, effective to kill mosquitoes, and relatively affordable. According to the survey conducted by Licorice (2017) to 500 Indonesian men and women respondents, 42.4 percent chose to use mosquito coils as their preference to prevent mosquito bites. Meanwhile, based on a survey by Moore *et al.* (2018), from 17 types of mosquito bites protection preferences, Mosquito coils are the fifth most chosen to prevent mosquito bites.

On the one side, insecticides are beneficial because they effectively kill insect pests, including mosquitoes. On the other side, insecticides also harm health because the exposure involves mosquitoes and humans (Prihati and Nugraheni, 2015). Exposure to mosquito coils in humans can lead to insecticide poisoning. The mosquito

coils are burning indoors and are often used overnight in sleeping quarters. This condition let the humans exposure to the smoke of mosquito coils that contained many chemical compounds for a long time and periodically (John and John, 2015). Furthermore, in order to improve energy efficiency, modern houses are often designed to be more airtight compared to older construction. It caused the buildings to tend to have a lower ventilation rate, which increased the risk of indoor exposure (Keig *et al.*, 2014).

Mosquito repellent is dangerous for humans because of the active ingredients contained in it. Propoxur, dichlorvos, chlorpyrifos, pyrethrin, diethyltoluamide, and pyrethroid-derived compounds are some of the active components included in the insect repellent. These substances are extremely hazardous, causing harm to the brain system (neurotoxic), the hormone system, and the respiratory and cardiovascular systems. Many studies have found that some of the active ingredients in mosquito coils, such as dichlorvos, are teratogenic, meaning they can cause cancer, stunt organ growth, cause prenatal mortality, and damage reproductive ability (Rahayuningsih, 2011).

Other studies have shown that exposure to propoxur in rats can cause fetotoxicity, reduce the number of offspring, and reduce fetal body weight. Pyrethrin is a pyrethroid derivative that is less hazardous than propoxur, dichlorvos, and chlorpyrifos. The effect is that it can irritate the eyes and sensitive skin and cause asthma. The pyrethrins used in mosquito repellents are d-allethrin, transfluthrin, bioallethrin, d-phenothrin, cyphenothrin, or esbiotrin (Nashibah, 2003).

In most cases, the active ingredients used in mosquito coils decompose quickly and can kill mosquitoes immediately. One of Indonesia's active ingredients widely used in mosquito coils is a pyrethroid. Pyrethroids are active ingredients found in mosquito coils circulating in the community. Pyrethroid insecticides are widely chosen because of their fast action in paralyzing and killing target insects. In addition, pyrethroids are also repellent. The synthetic properties of pyrethroids are non-volatile (low volatility), and high insecticide potential (Sigit *et al.*, 2006).

The pregnancy period is a time when women are prone to environmental influences. Not only for the mother but also for the safety of the fetus she is carrying, especially during the organogenesis stage, because at that stage, the fetal cells are actively proliferating. The repeated use of chemical compounds can temporarily cause accumulation in the fetus because the fetus does not yet have a fully functioning metabolic system (Manson, 1986). In the early stages of pregnancy, the external effect of a teratogenic substance is usually fatal, resulting in abortion (the agent is embryotoxic). The differentiation of cells happens in the following stage, resulting in the formation of organs, which are unique groups of cells that perform the same job. During this time, any disruption in cell differentiation leads to a severe congenital disability if it does not result in death (the agent is teratogenic) (Sinha *et al.*, 2004).

According to Sinha *et al.* (2004), Chronic neurotoxicity has been linked to long-term indoor exposure to pyrethroid-based MRs, including blood-brain barrier failure and oxidative brain damage. Sinha *et al.* (2006) also stated that exposure to pyrethroid during pregnancy leads to fetus cholinergic dysfunction and the effects are learning and memory deficiencies.

Further modifications have been continued in order to develop a new pyrethroid having excellent knockdown activity for house flies and cockroaches, and mosquitoes and innocuous for humans. A new pyrethroid named dimefluthrin was discovered by modifying the alcohol part of natural pyrethrin to 4-methoxymethyl-2,3,5,6-tetrafluorobenzyl alcohol. Dimefluthrin is claimed to have excellent knockdown insect activity (Mori, 2019).

Various pyrethroid insecticides have long been utilized as active components in mosquito coils. The active element in an X-brand mosquito coil is dimefluthrin, which belongs to the pyrethroid class. In contrast to other brands that employ modest concentrations, such as brand Y, which uses as much as 0.015 percent pyrethroids (metofluthrin), mosquito coil X uses a greater dose of 0.05 percent pyrethroids (dimefluthrin). Despite claims that pyrethroids have lower toxicity and are relatively safe, however, it is unknown whether dimefluthrin has a potential risk to pregnant mice. Therefore, studies will focus on the potential risk of dimefluthrin in damaging the pregnancy of mice.

1.2 Problem Formulation

1. How do exposure to mosquito coils containing dimefluthrin affect mice viability?
2. What is the effect of exposure to mosquito coils containing dimefluthrin on the weight and length of Fetal?
3. How is the effect of exposure to mosquito coils containing dimefluthrin on maternal weight gain and uterine final weight of mice?
4. How do mosquito coils exposure during pregnancy affect fetal defects in mice?

1.3 Research Objectives

1. To analyze the effect of exposure to mosquito coils containing dimefluthrin on mice viability
2. To analyze the effect of exposure to mosquito coils containing dimefluthrin to weight and length of fetal
5. To analyze the effect of exposure to mosquito coils containing dimefluthrin on maternal weight gain and uterine final weight of mice
3. To understand the effect of mosquito coils exposure during pregnancy to a fetal defect in mice

1.4 Significance of The Research

The significance of this research is to expand scientific information concerning the potential risk of dimefluthrin in damaging fetal and the pregnancy.

