Atlas of Science
another view on science
https://atlasofscience.org

Am I at risk of developing diabetes if exposed to insecticide?

The answer is: it depends. Of course, there is no trivial answer to an open question like that when referring to scientific investigation. But we can make you think better before exposure to certain pesticides like malathion.

Malathion is an insecticide still used in agriculture, gardening, and spraying to eradicate mosquitoes such as Aedes aegypti, which transmits dengue and other diseases. Despite being considered carcinogenic by the International Agency for Research on Cancer, it was Brazil's seventh most commercialized pesticide in 2020 (15.7 thousand tons). With a quick Google search, anyone can buy a bottle of the product for less than U$ 3 in Brazil and, indeed, in many other countries where it is still applied for the abovementioned purposes.

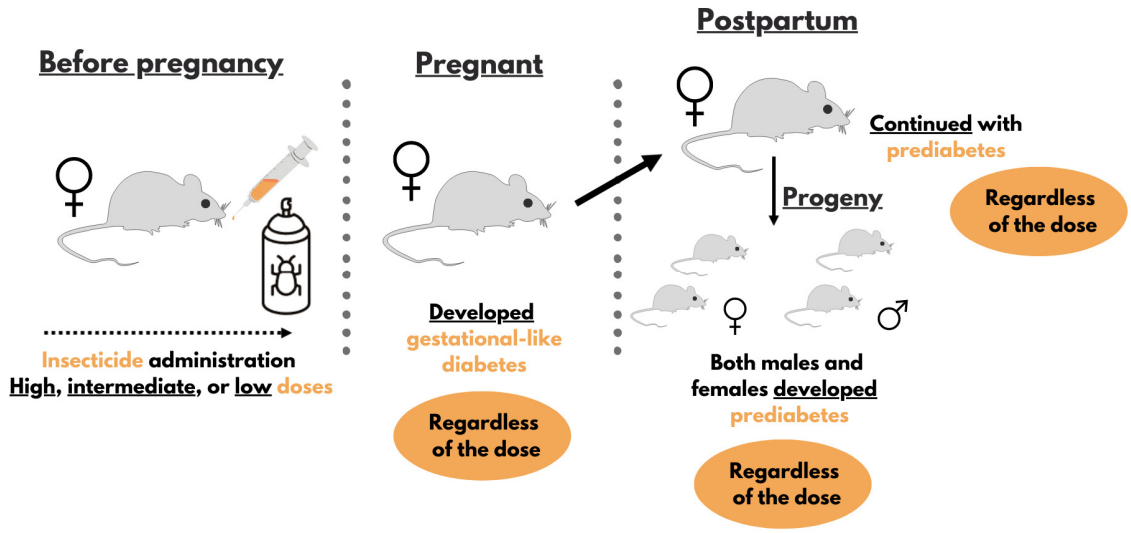

Fig. 1. Scheme of malathion treatment and the main outcomes observed. Adult female rats received daily malathion treatment through oral vial with one of the following doses: 0.1 (low), 14 (intermediate), or 140 mg/kg (high) for 21 consecutive, while the control group was treated with corn oil (1 ml/kg, bm). The progenitor rats were followed during the next 60 days after term, while the offspring (both sexes) were followed until completed 90 days old. A glucose tolerance test revealed glucose intolerance during the gestational period (equivalent to gestational diabetes), which persisted at postpartum (60 days after term) (equivalent to prediabetes). Both male and female progeny became glucose intolerant (equivalent to prediabetes). This alteration in glucose homeostasis occurred regardless of the dose of malathion exposure.

The study was born to analyze how previous exposure to malathion could affect the metabolism of pregnant and postpartum rats and their progeny. For this, laboratory rats were divided into four groups: a control group, which received a placebo, and three other groups receiving different doses of the pesticide. In the first one, a high dose was applied, which would approximate intoxication by the product, which could result from an accident or deliberate misuse of the insecticide. In the second group, an intermediate dosage was used, simulating the exposure of a worker who does not use adequate protection or does not follow the application recommendations defined by legislation. This dosage is in the range of no observable adverse effect level (NOAEL) and, according to regulatory agencies, should not imply health concerns. Finally, the third group

received the lowest dose, within a range compatible with the acceptable daily intake (ADI). This is the amount that, according to regulatory agencies, can be consumed safely, daily, throughout a lifetime (these are pesticide residues that may be present in food or water).

The insecticide was given to the female rats for 21 days (Fig. 1.), then they were subjected to the males to mate. Malathion administration was interrupted when the pregnancy was confirmed. With this, we could imagine something like a woman who works in the crops with some inadequate handling of pesticides and discovers she is pregnant. So she came with the previous exposure, found or planned the pregnancy, and interrupted the exposure. And then what happens?

Malathion exposure resulted in the equivalent, in humans, of gestational diabetes (a disease that increases the risk of a series of complications during pregnancy, childbirth, and for the baby) (Fig. 1.). Even after giving birth, the 'mother' rats maintained characteristics equivalent to prediabetes (a condition characterized by high blood sugar levels, but not enough to be classified as diabetes, despite indicating a propensity to develop the disease) (Fig. 1.).

The study also points out that malathion is a potential endocrine disruptor, a chemical that causes changes in our endocrine system, responsible for releasing various hormones. This is because the rats – during and after pregnancy – developed two parameters of predisposition to obesity: increased amount of abdominal fat and dyslipidemia. In addition, the offspring, even those not directly exposed to the pesticide, became prediabetic as adults (Fig. 1.). All these effects, both in mothers and progeny, happened regardless of the dose of malathion.

The study, therefore, reinforces the evidence that the environment in which the mother lives during or before pregnancy can affect her and her offspring's health, such as predisposing them to diabetes. In addition, it is expected that the study will help regulatory agencies review the acceptable doses of malathion such as NOAEL and ADI.

Alex Rafacho
Laboratory of Investigation in Chronic Diseases – LIDoC, Department of Physiological Sciences, Center of Biological Sciences, Federal University of Santa Catarina – UFSC, Florianópolis, Brazil

Publication

Preconception exposure to malathion and glucose homeostasis in rats: Effects on dams during pregnancy and post-term periods, and on their progeny
Bruxel MA, da Silva FN, da Silva RA, Zimath PL, Rojas A, Moreira ELG, Quesada I, Rafacho A
Environ Pollut. 2023 Jan 1