

Probabilistic Risk Assessment of Dietary Exposure to Aflatoxin through maize consumption

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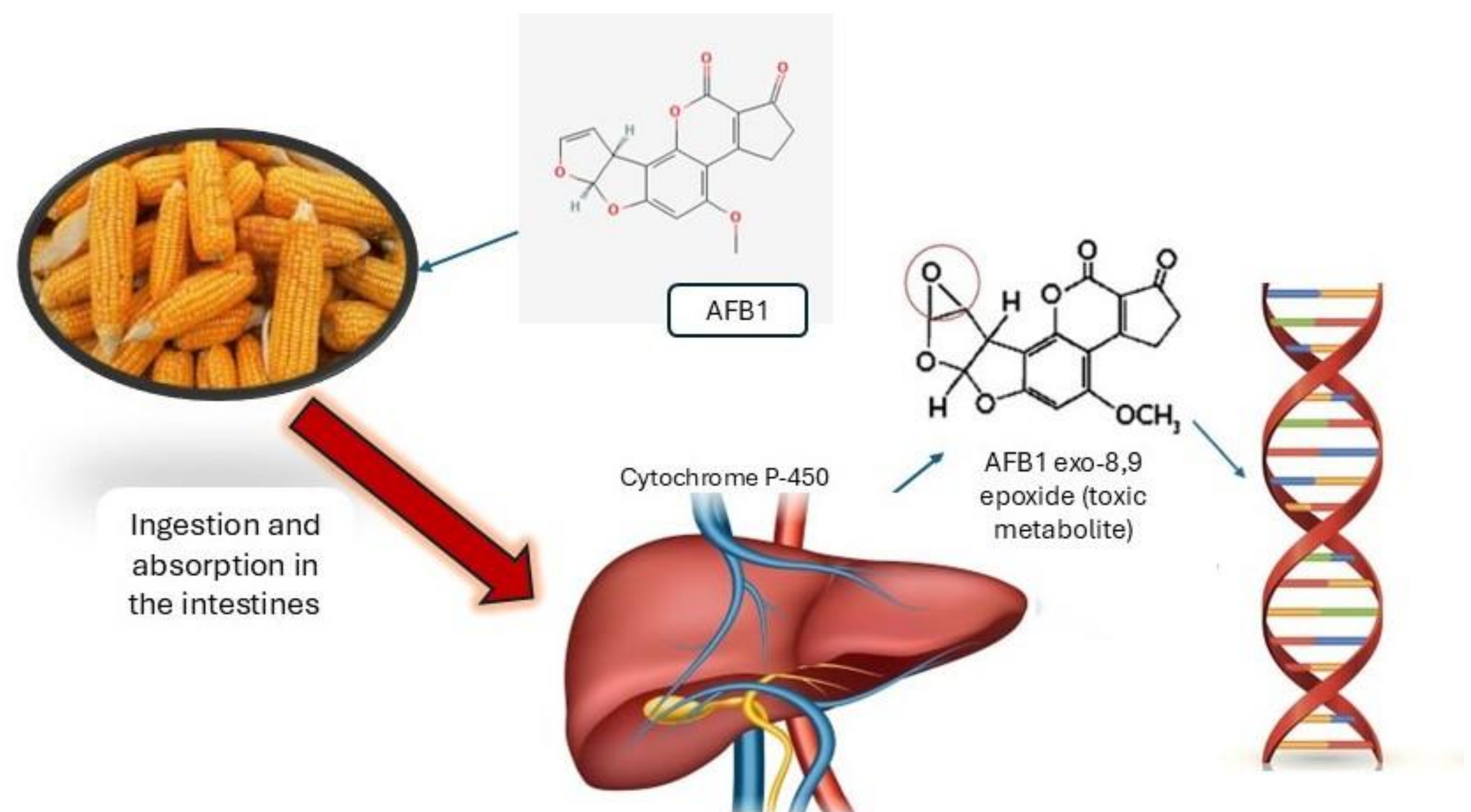
- ❖ The mean and 95th percentile lifetime cancer risk values for The Philippines indicate a cancer risk ($\geq 1 \times 10^{-6}$) due to the high intake rate of maize, which could be contaminated with AFB1. Approximately 7.8 in 100,000 people might develop cancer due to exposure over their lifetime. This exceeds the acceptable risk set by USEPA and WHO. Efforts to mitigate aflatoxin contamination and exposure, along with hepatitis B vaccination programs, can considerably reduce the risk of liver cancer.

BACKGROUND

Aflatoxins are a group of naturally occurring mycotoxins produced by fungi, primarily *Aspergillus flavus* and *Aspergillus parasiticus*, ubiquitous in the environment. These fungi generally contaminate crops such as corn, peanuts, and tree nuts. A majority of the world's estimated cases (54.3%) and deaths (54.1%) from liver cancer come from Eastern Asia. Studies have shown that aflatoxin B1 (AFB1) is a carcinogen and leads to the development of hepatocellular carcinoma (HCC) in animals and humans. The general population is exposed to AFB1 through the consumption of crops. *Therefore, this study aimed to perform a probabilistic human health risk assessment of aflatoxin intake by consuming maize and maize products.* The health risks derived from dietary exposure to aflatoxin were assessed for adults (19-60 years) in four Eastern Asia Countries (India, the Philippines, Malaysia, and Indonesia). The tropical climate in this region favors the growth of aflatoxin contamination of maize.

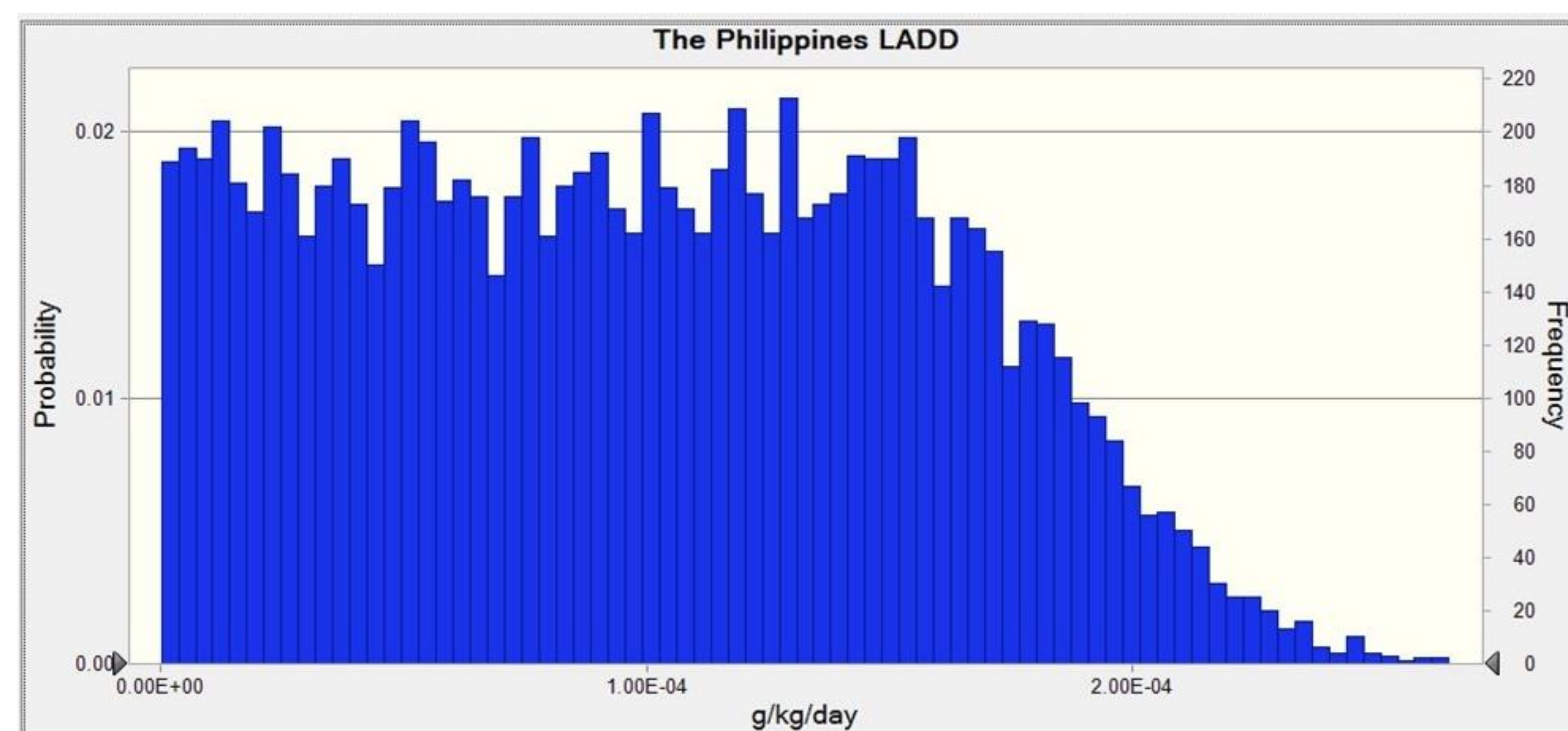
METHODS

Data on maize consumption rates for all countries were obtained from the Food and Agricultural Organization (FAO), and we extracted values for the concentration of aflatoxins from published research. The consumption rates for the Philippines, Indonesia, India, and Malaysia were 82, 0.07, 0.25, and 4 g/day, respectively. Aflatoxin concentrations in maize ranged from ND to 134.6 ppb. The lower-bound benchmark dose (BMDL₁₀) used in our analysis is 400 ng/kg/day (EFSA, 2020). Lifetime average daily dose (LADD) values were calculated using Crystal Ball software based on a Monte Carlo simulation with 10,000 iterations.



RESULTS CONTINUED

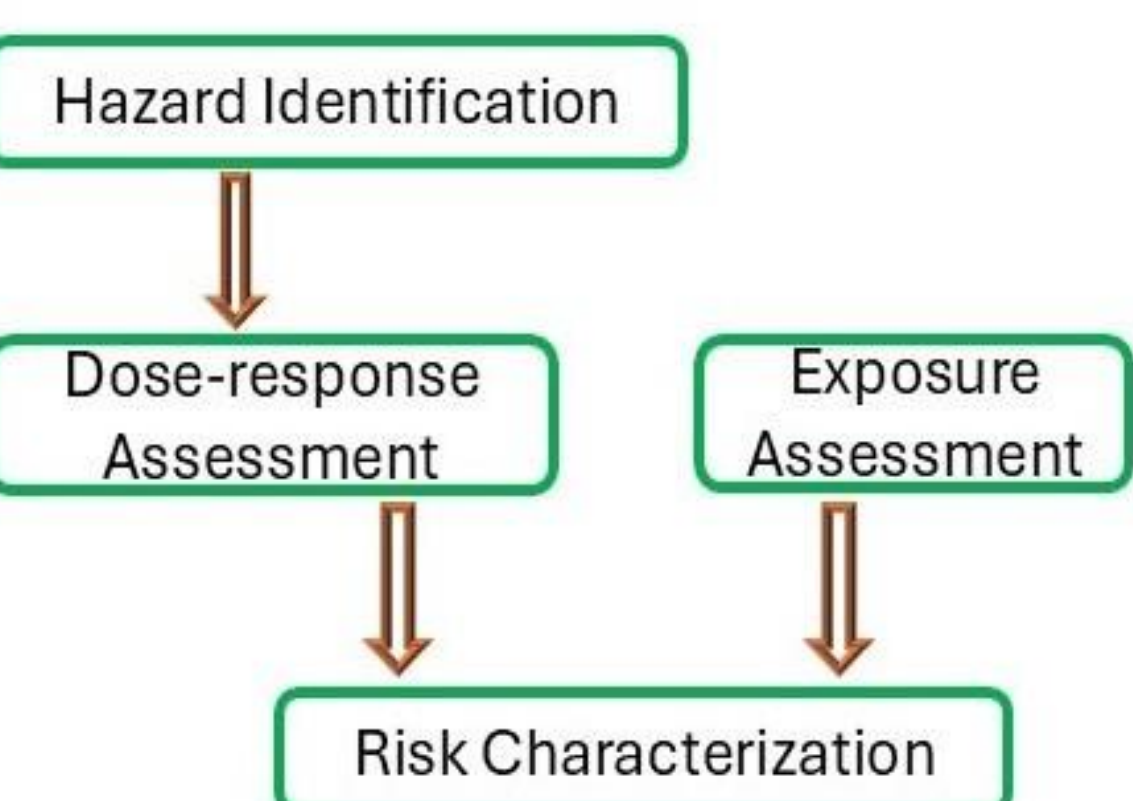
Country	Corn consumption (g/day)	Mean Cancer risk	95 th Percentile Cancer risk
Philippines	82	3.9×10^{-5}	7.8×10^{-5}
Malaysia	4	1.7×10^{-6}	3.3×10^{-6}
Indonesia	0.07	3.3×10^{-8}	6.6×10^{-8}
India	0.25	1.5×10^{-7}	2.9×10^{-7}



$$\text{LADD} = \frac{\text{Conc.} \times \text{Intake Rate} \times \text{Exposure Duration}}{\text{Body Weight} \times \text{Average Time}}$$

$$\text{CSF} = 0.1 / \text{BMDL}_{10}$$

$$\text{Cancer Risk} = \text{LADD} \times \text{CSF}$$



RESULTS

The results show mean values and 95th percentile. The mean cancer risk values for the Philippines, Indonesia, India, and Malaysia were 3.9×10^{-5} , 3.3×10^{-8} , 1.5×10^{-7} and 1.7×10^{-6} , respectively. The lifetime cancer risk values for The Philippines indicate a cancer risk ($\geq 1 \times 10^{-6}$) due to the high intake rate of maize, which could be contaminated with AFB1.

CONCLUSIONS

- Long-term consumption of aflatoxin-contaminated maize increases the cumulative exposure and cancer risk over a lifetime.
- In regions where maize is a dietary staple and storage practices are poor, there is much higher risk of aflatoxin contamination and associated cancer.