

Executive summary

An estimated 500 million of the poorest people in sub-Saharan Africa, Latin America, and Asia are exposed to mycotoxins at levels that substantially increase mortality and morbidity (Pitt et al., 2012). The problem is not newly recognized. Shortly after the discovery of aflatoxins, the impact on child health was brought into immediate focus. After the reporting of several deaths in children in Africa due to consumption of aflatoxin-contaminated meal, a decision was made in 1966 by the FAO/WHO/UNICEF Protein Advisory Group to set a limit of 30 ppb aflatoxin in protein supplements made from groundnuts (Anonymous, 1966). In contrast to the situation today, in 1966 throughout most of Africa the proportion of calories from maize was modest, with a greater proportion coming from sorghum, millet, and cassava.

The International Agency for Research on Cancer (IARC) of the World Health Organization convened a Working Group Meeting in Lyon from 30 June to 3 July 2014. This IARC Working Group Report provides a systematic, independent review of the scientific evidence base on the adverse health effects from aflatoxin and fumonisin exposure through consumption of contaminated maize and groundnuts. An evaluation is provided of interventions, available on an individual and a community level, to reduce human exposure and disease. Therefore, this Report provides an authoritative basis for action at an international level, enabling decision-makers to invest with confidence in effective strategies to save lives. It also provides guidance on additional critical stud-

ies needed to yield further evidence of the merit of specific intervention approaches.

The Working Group addressed current scientific knowledge in four key areas: the extent of exposures to aflatoxin and fumonisin; the effects on prenatal, infant, and child health; relevant mechanistic information; and effective intervention strategies in low-income settings. In the past, the focus has largely been on the impact of aflatoxin on cancer risk. Considering several recent studies, mainly in Africa, this Report also considers the potentially far greater burden of growth faltering after weaning (child stunting).

Stunting in children results from chronic undernutrition, leading to adverse effects on survival, health, and development, entailing a large

global population burden; in 2012, an estimated 162 million children younger than 5 years worldwide were stunted. Poor-quality diets and high rates of infection, both in pregnancy and in the first years of life, result in poor child growth, but the relative contributions to stunting are unknown. At the same time, provision of all of the established nutrition-specific interventions in the most affected regions would reduce the prevalence of stunting by only about 20% (Bhutta et al., 2013), illustrating the large knowledge gap in how to prevent stunting, including the potential impact of exposure to mycotoxins.

This Report concludes that surveillance data on exposure to aflatoxins are generally lacking outside the developed countries. However, available data from measurements of contaminated crops and through the use of exposure biomarkers in exposed populations demonstrate that mycotoxin exposures can be high throughout Africa, as well as in Latin America and parts of Asia. More recently, among maize-consuming populations in these regions, the high concurrent exposure to aflatoxins and fumonisins has been documented.

Notwithstanding the challenges, future mycotoxin monitoring programmes should be prioritized. Assessment of possible implementation within existing surveillance systems should be considered. In the short term, data from individual studies of sufficient quality should be added to the Global Environment Monitoring System (GEMS)/Food Contamination Database. Finally, a rapid screening approach aimed at the field/subsistence-farming level that

is inexpensive and user-friendly and has a wide dynamic range should be developed. This could support a rapid alert system that informs responses and appropriate actions for food safety.

Aflatoxins are a cause of human liver cancer and, in high doses, have caused deaths from aflatoxicosis. More recently, significant negative effects of aflatoxin on child growth have been reported, as well as immune modulation. These observations are consistent with impaired fetal development and immune system and gut function in animal models. Taken together, the few well-documented population-based studies and the mechanistic data in relevant animal models suggest that mycotoxin exposure contributes to stunting, independent of and with other risk factors. Further longitudinal studies of mycotoxin exposure and child stunting, including studies of the underlying mechanisms, merit investment.

The Working Group assessed the question of effective interventions in low-income countries using studies where there was reliable direct or indirect evidence of improvement of health, including reduced mycotoxin biomarker levels. Using widely accepted criteria for evaluating evidence about public health interventions, some 15 interventions were placed into one of four categories: (1) sufficient evidence for implementation, (2) needs more field evaluation, (3) needs formative research, and (4) no evidence or ineffective. Recommendations on how to approach the necessary further investigation and potential scale-up were also considered.

Four of the interventions were judged to be ready for implementation. The intervention for which the strongest evidence of improvement of health exists, but which is also the most difficult to achieve, was to increase dietary diversity. Other strategies deemed ready for implementation were sorting of the crop; a package of post-harvest measures, including improved storage; and, in Latin America for maize, optimized nixtamalization. Several interventions were considered that might be used in emergency situations of extremely high contamination (e.g. chemoprotectants, agents that can be put into the diet to ameliorate the effects of aflatoxin once ingested).

As currently envisaged, the recommendations would be relevant for investment of public, nongovernmental organization, and private funds at the scale of the subsistence farmer, the smallholder, and through to a more advanced value chain.

References

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