Dietary aflatoxin exposure and impaired growth in young children from Benin and Togo: cross sectional study

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Fetal and early childhood environment, including the nutritional status of the pregnant mother and the infant, are considered critical for growth and risk of disease in later life. Many people in developing countries are not only malnourished but also chronically exposed to high levels of toxic fungal metabolites (mycotoxins). One family of mycotoxins, the aflatoxins, are carcinogenic and immunotoxic and cause growth retardation in animals. Aflatoxins contaminate staple foods in West Africa, particularly maize and groundnuts, as a result of hot, humid storage conditions that occur throughout the year in tropical environments. The Ministries of Health in Benin and Togo gave ethical approval, and parents gave informed consent. We determined aflatoxin exposure using a validated method, and anthropometrical measurements and growth were assessed using the World Health Organization growth charts. Over 20% of children had growth that was more than two standard deviations below the median. The potential for aflatoxin exposure in patients with acute stroke can be improved significantly by greater use of emergency services and expediting evaluation and investigations by doctors.
weight for age, height for age, and weight for height z scores, according to the median value of a WHO Health Organization reference population. A z score <−2 is classified as malnutrition, and ≤−3 represents severe malnutrition. We also determined weaning status and the socioeconomic status of the mother and family. We assessed aflatoxin exposure over the previous two to three months by measuring aflatoxin bound to albumin in blood.³

We detected aflatoxin-albumin adducts in 475/479 (99%) samples (one sample missing), with a geometric mean concentration of 32.8 (range 5-1064) pg/mg albumin. Aflatoxin-albumin concentration increased with age up to 3 years, after which it reached a plateau. In the 302 children aged 3 years or under, the mean concentration of 32.8 (range 5-1064) pg/mg was 2.5-fold higher in fully weaned children (45.6 pg/mg; 95% confidence interval 38.8 to 53.7) than in those still partially breast fed (18.0 pg/mg; 95% confidence interval 15.2 to 21.3). In a multiple variable model adjusting for age, sex, socioeconomic status, and agro-ecological zone, wasting status was significantly associated with aflatoxin-albumin concentration (P=0.0011).

Prevalence of malnutrition was 33% for stunting (height for age z score ≤−2), 29% for being underweight (weight for age z score ≤−2), and 6% for wasting (weight for height z score ≤−2). Children with stunting or who were underweight had 30-40% higher mean aflatoxin-albumin concentrations. After adjustment as above, the negative correlation between individual aflatoxin-albumin concentration and each of the three growth parameters was highly significant (P=0.001 for height for age, P=0.005 for weight for age, and P=0.047 for weight for height). In a categorical analysis, the association with aflatoxin-albumin concentration was again significant, with clear dose-response relations with height for age and weight for age z scores (figure).

Comment
This study reveals a striking association between exposure to aflatoxin in children and both stunting (a reflection of chronic malnutrition) and being underweight (an indicator of acute malnutrition). In West Africa, people are chronically exposed to high levels of aflatoxins starting in utero and continuing throughout life.¹ In this study, children still partially breast fed had lower exposure, almost certainly reflecting lower toxin levels in milk than in weaning and family foods. Thus growth faltering occurs at a time of change to solid foods, when there is co-exposure to aflatoxin and a plethora of infectious hazards (for example, malaria, diarrhoea, respiratory infections). Whether the association between aflatoxin exposure and impaired growth is a direct result of aflatoxin toxicity or reflects consumption of fungus affected food of poor nutritional quality cannot be confirmed from the cross sectional design. However, these observations emphasise the need to investigate this question and to develop strategies to reduce exposure to aflatoxin, possibly involving interventions targeted at the post-weaning period in African children.²

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Contributors: Y Y G , K C, A H, P C T, A J H, and C P W were all responsible for the design of the study. K C, A H, S E, and A J H took part in the fieldwork. Y Y G and P C W were responsible for the laboratory analysis. Y Y G and S E computed the data and conducted the statistical analysis. All authors contributed to writing the manuscript. C P W is guarantor for the paper.

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References

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