Biomarkers of aflatoxin exposure, diet, climate and linear growth in rural Ethiopia

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Introduction

- There has been growing recognition that aflatoxins are associated with impaired linear growth of children.
- The relationship between aflatoxin (AF) biomarkers in serum and child growth in Ethiopia has not been investigated.
- We first assess the effect of different factors on exposure:
  - Climate: temperature and relative humitidy (fungi thrive better under humid and high-temperature conditions)
  - Diet: importance of maize (more prone to aflatoxins than other cereals)
  - Storage type
  - Seasonality: climate, diet, storage change with seasons
- We assessed children's exposure to AF in pre-harvest and post-harvest seasons using serum biomarkers and tested the association of their exposure with the linear growth.

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Methods – data collection

- AF biomarkers were quantitatively analyzed from a randomly-selected subsample of an ongoing intervention trial on the consumption of quality-protein maize in rural Ethiopia.
- Blood samples were collected from 6-36-month-old children (n=102) in the pre-harvest season (Aug-Sept 2016), and post-harvest season (Feb 2016).
- The AF biomarkers AF-lysine, AFB1, AFB2, AFG1, AFG2, and AFM1 were measured by high-performance liquid chromatography-tandem mass spectrometry.

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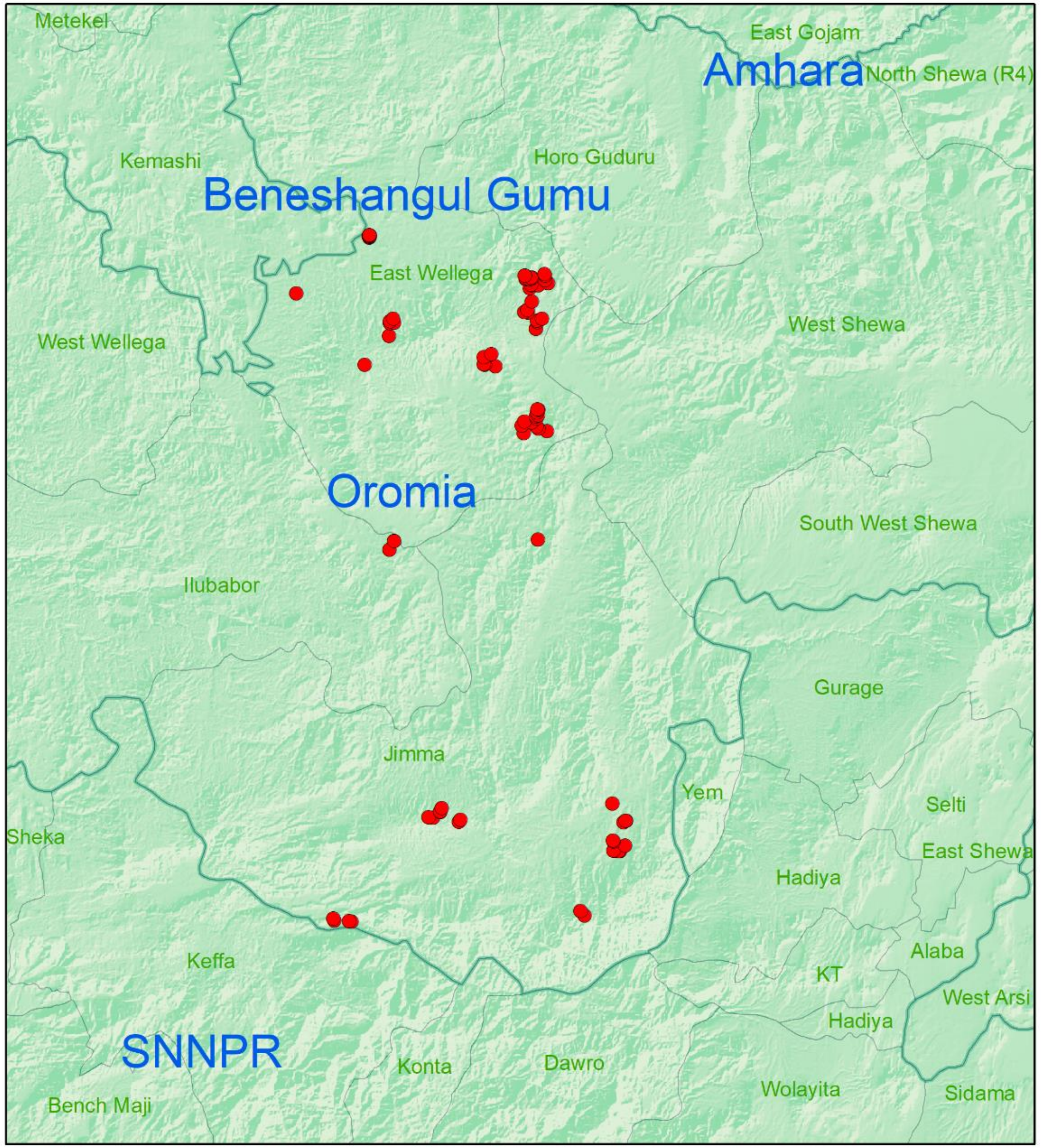


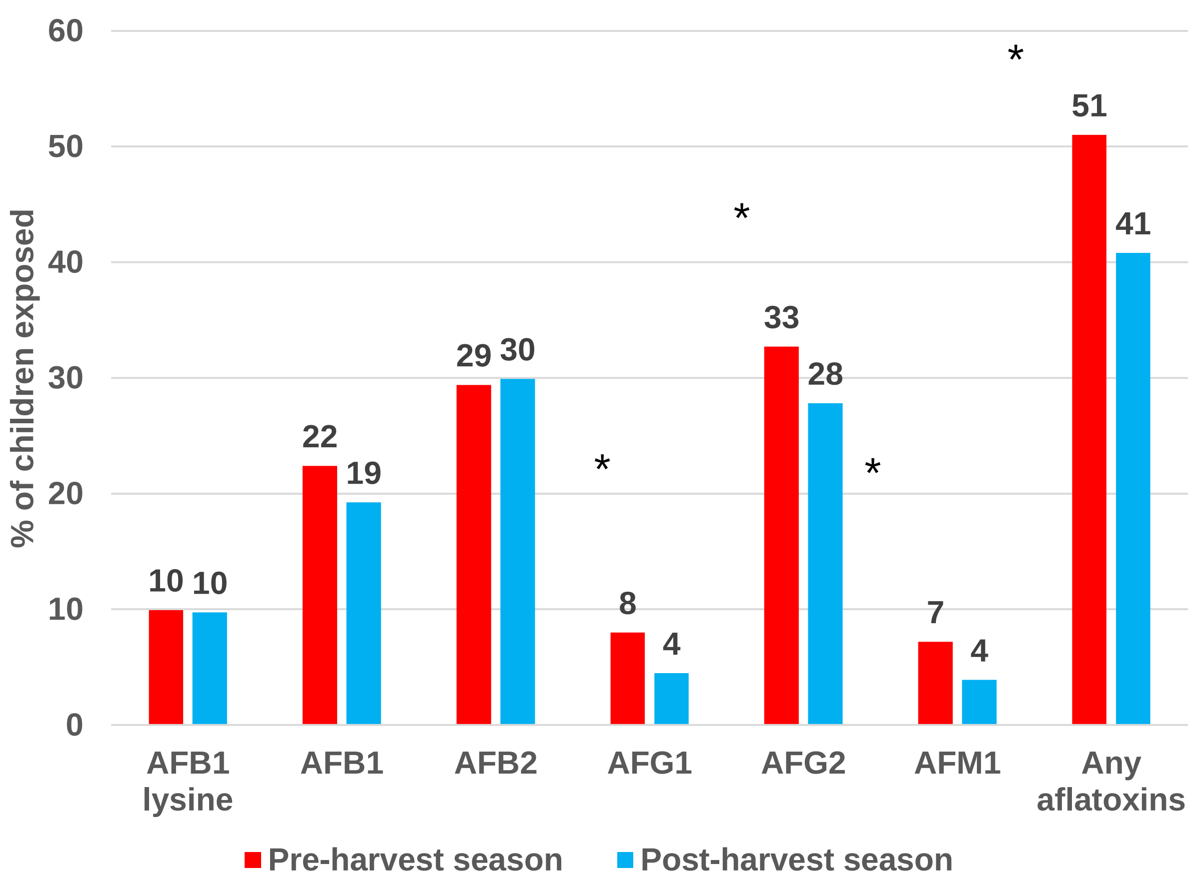
Methods – GIS analysis

- Climate data were obtained from the World Meteorological Institute, in the format of grid layers with relative humidity and average temperature.
- From the grids, the values for the georeferenced homesteads of the children were extracted.

Methods - Analysis

- Children's linear growth was assessed by length/height and age converted into Z-scores for height-for-age.
- Information on diets and storage practices were obtained from the survey.
- Correlation and mixed linear regression regression were used for the analysis.

Aflatoxins exposure and seasonality



- A high percentage of children were exposed to AF in serum in both pre-harvest (7% to 31% by AF) and post-harvest (5% to 33% by AF) seasons,
- The exposure did not differ statistically by seasons except for AFG2.
- Cumulative exposure, i.e. children with one or more AF biomarkers in serum, was higher in post-harvest (45%) compared with pre-harvest (40%) seasons (p=0.003).

Exposure and climate

Aflatoxins (post harvest)	Statistic	Altitude	Temperature	Relative Humidity
AFB1Lysine	Pearson Correlation	-.213*	0.204	0.077
	Sig. (2-tailed)	0.032	0.052	0.470
	N	102	91	91
AFB1	Pearson Correlation	-0.066	0.111	0.018
	Sig. (2-tailed)	0.507	0.293	0.867
	N	102	91	91
AFB2	Pearson Correlation	0.043	-0.001	-0.023
	Sig. (2-tailed)	0.670	0.989	0.832
	N	102	91	91
AFG1	Pearson Correlation	-0.046	0.075	-0.049
	Sig. (2-tailed)	0.645	0.478	0.642
	N	102	91	91
AFG2	Pearson Correlation	0.171	-0.144	-0.056
	Sig. (2-tailed)	0.085	0.174	0.599
	N	102	91	91
AFM1	Pearson Correlation	0.081	-.221*	0.052
	Sig. (2-tailed)	0.418	0.035	0.626
	N	102	91	91

- Pre-harvest, Aflatoxins exposure is not significantly related to either relative humidity or temperature
- Post-harvest: two correlations significant
- However: little variation in the locations

Exposure and diet

Aflatoxins	Statistic	Maize cooked	Maize consumed	Maize % in diet
AFB1Lysine_preh	Pearson Correlation	-0.089	-.237*	-0.166
	Sig. (2-tailed)	0.374	0.018	0.099
	N	102	100	100
AFB1_preh	Pearson Correlation	-0.150	-0.062	-0.059
	Sig. (2-tailed)	0.131	0.537	0.559
	N	102	100	100
AFB2_preh	Pearson Correlation	-0.068	-0.186	-.241*
	Sig. (2-tailed)	0.495	0.064	0.016
	N	102	100	100
AFG1_preh	Pearson Correlation	0.136	-0.017	-0.153
	Sig. (2-tailed)	0.173	0.868	0.127
	N	102	100	100
AFG2_preh	Pearson Correlation	-0.127	-0.020	-0.070
	Sig. (2-tailed)	0.204	0.841	0.491
	N	102	100	100
AFM1_preh	Pearson Correlation	-0.018	0.127	0.098
	Sig. (2-tailed)	0.860	0.208	0.334
	N	102	100	100

- No correlation of maize consumption in post-harvest samples
- Two negative correlations in pre-harvest
- No evidence maize consumption increases aflatoxins exposure

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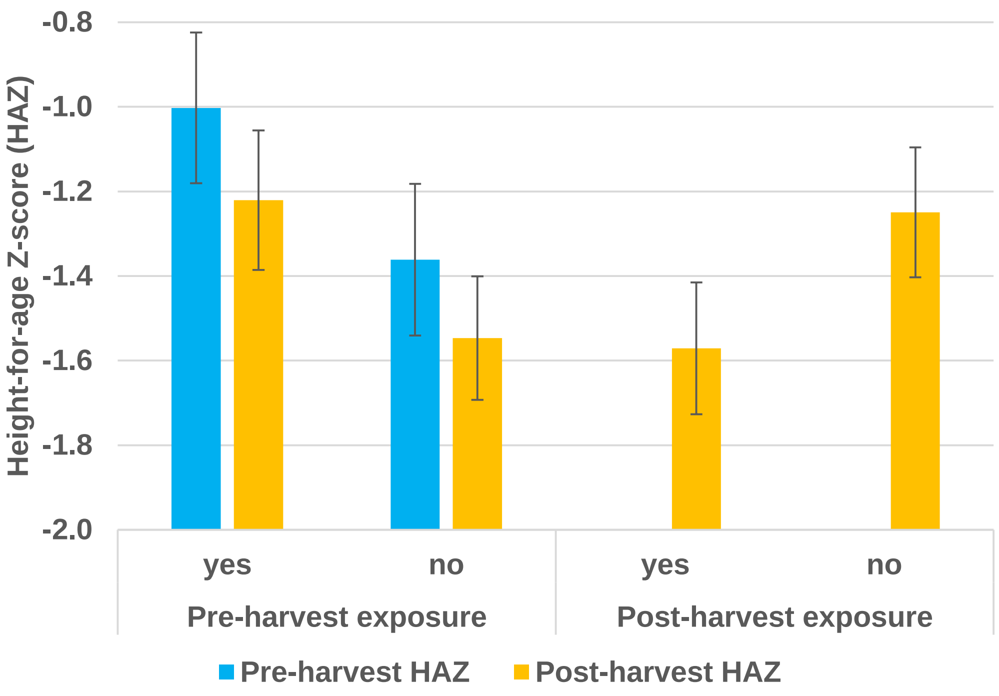
Exposure and linear growth



- CAFES and linear growth was not correlated in the pre-harvest season in this sample of children (r= 0.17, p=0.095).
- Cumulative AF exposure in serum (CAFES) was correlated with the linear growth of children in the post-harvest season (r=-0.21, p=0.034)

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Concluson

- Our findings show that exposure to AF is highly prevalent in the study area (maize growing areas of Oromia).
- We did not find an effect of climate, but the samples all came from a similar climate. For future research, samples should be taken from a wider range of climates.
- We do not find an effect of maize consumption on aflatoxins exposure
- We do find that cumulative aflatoxins exposure in serum was correlated with the linear growth of children in the post-harvest season
- Further longitudinal study with a larger samples size is needed to evaluate causal linkages between AF exposure and linear growth in children.

Thank you for your interest!