

# ASSESSMENT OF AFLATOXIN EXPOSURE IN SCHOOL-AGED CHILDREN IN SOUTHERN ETHIOPIA

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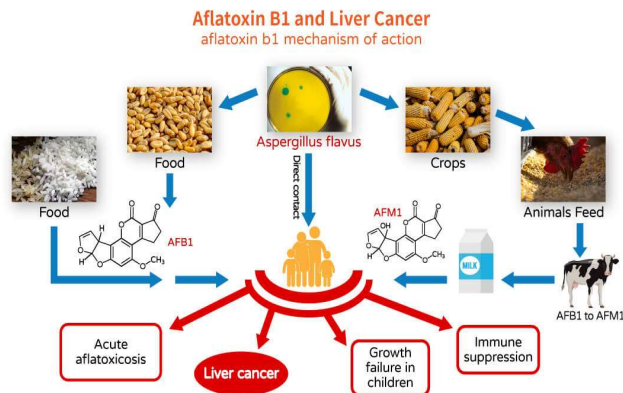
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## Abstract

**Introduction:** Aflatoxins (AF), a naturally occurring fungi are known to contaminate staple crops in low-income countries. Exposure to AFs may have detrimental effects on health such as hepatocellular carcinoma, immune suppression, and growth impairment. The aim of the current study was to examine the prevalence of AF exposure in school-aged children and evaluate its association with socio-economic and demographic characteristics and dietary intake of households. **Methods:** This study utilizes secondary data, from a cross-sectional study of 408 school-aged children. Urine samples were analyzed for aflatoxin M1 (AFM1) concentration. Moreover, socioeconomic, and demographic characteristics and dietary intake data were collected. Data were presented as frequency distributions, percentages, and means (SD). Skewed data were log-transformed before analysis. Multiple Classification Analysis (MCA) was used to predict the AFM1 concentration of the children. **Results:** Urinary AFM1 was detected in more than 93% of the children in variable amounts. The median [IQR] concentration of AFM1/Creat was 472.7 [200,1111] pg/ml. The MCA revealed that child age ( $p=.026$ ), household size ( $p=.039$ ), mothers' occupation ( $p=.005$ ), consumption of haricot bean ( $p=0.010$ ) and cow milk ( $p=.021$ ), and dietary diversity score ( $p=.010$ ) were all significantly associated with AFM1 concentration. **Conclusion:** High exposure to AFM1 was observed in this study. Frequent consumption of certain food products and socio-economic status of households were significantly associated with urinary AFM1. However, since the relation between AFM1 and dietary intake was analyzed based on self-reported data it is recommended that all of the staple foods, as well as animal feeds in the study area should be assessed for AFM1 contamination.

## Background

- Aflatoxins (AF) are mycotoxins, a secondary metabolite of fungi, and are in the genus *Aspergillus*. Aflatoxin B1 (AFB1), the most toxic type of AF is classified as a group-1 carcinogen, and aflatoxin M1 (AFM1) a metabolite of AFB1, are the predominate hepatotoxic AFs<sup>1,2</sup>. Exposure to AFs has detrimental effects on human health such as aflatoxicosis, hepatocellular carcinoma, immunosuppression, and growth impairment<sup>2-4</sup>.
- Low-income populations and rural areas such as those found in sub-Saharan Africa are particularly at risk for AF exposure. The tropical, hot, and humid climate of sub-Saharan Africa provides the optimal conditions for AF contamination of staple crops such as maize and groundnuts<sup>1,3</sup>.
- In order to work towards decreasing AF exposure in populations, it is critical to understand the socio-economic and demographic factors that are associated with AF exposure. Studies done in some countries of Africa have found that characteristics such as education, income, area of residence, gender, age, household size, farming practices, and diets were all associated with AF exposure<sup>5-7</sup>.



## Methods

- This is a secondary analysis study utilizing cross-sectional data collected in May - June 2017 from Shebedino woreda, Sidama Zone, southern Ethiopia.
- 408 randomly selected school-aged children that were 6-12 years of age were included in the study. Demographic and socio-economic characteristics, food consumption pattern of households, and household food insecurity questionnaires were answered by the mothers of the children. Urine samples were collected from all children and were analyzed for AFM1 and creatinine concentration.
- Frequency distributions, percentages, and mean (SD) were used to describe the socio-economic and demographic characteristics of the respondents. Skewed creatinine adjusted AFM1 data were log transformed before analysis. Multiple classification analyses was used to predict the urinary AFM1 concentration of the children.

## Results

Table 2. Result of multiple classification analysis (MCA) for the key determinants of school children AFM1 (pg/ml) by selected predictors and covariates (n = 408)

Variable	n	Mean AFM1				Sig
		Unadjusted mean	Eta ( $\eta$ )	Adjusted mean	Beta ( $\beta$ )	
<b>Child age</b>			.106		.109	.026 <sup>c</sup>
- 6 - 9	177	214.8		214.5		
- 10 - 12	139	251.2		251.6		
<b>Child sex</b>			.081		.09	0.35
- Male	62	206.8		204.5		
- Female	64	230.1		232.4		
<b>HAZ<sup>f</sup></b>			.06		.08	.36
- Stunted	24	200.5		195.9		
- Not stunted	102	223.1		224.0		
<b>HH size<sup>g</sup></b>			.130		.135	.039 <sup>c</sup>
- 2 - 4	139	215		217.4		
- 5 - 7	155	247		242.8		
- 8 - 11	19	304		317.5		
<b>Mother's education</b>			.05		.072	.155
- Illiterate	162	245		248		
- Literate	151	227		223		
<b>Mother's occupation</b>			.164		.163	.005 <sup>b</sup>
- Farming	149	264		264		
- Non-farming	164	205		206		
<b>F<sup>h</sup> corn</b>			.013		.051	.076
- Once a day	132	234		228		
- More than once a day	181	239		247		
<b>F<sup>h</sup> haricot beans</b>			.166		.198	.010 <sup>b</sup>
- Rarely <sup>d</sup>	126	202		198		
- Sometimes <sup>e</sup>	106	246		243		
- Every day	81	275		286		
<b>F<sup>h</sup> milk</b>			.144		.113	.021 <sup>c</sup>
- Never	101	199		207		
- Sometimes <sup>e</sup>	212	254		250		
<b>F<sup>h</sup> kale</b>			.081		.044	.452
- Never	267	230		233		
- Sometimes	46	270		255		
<b>DDS<sup>h</sup></b>			0.138		.135	.032 <sup>c</sup>
- Low	252	278		277		
- Adequate	75	219		220		

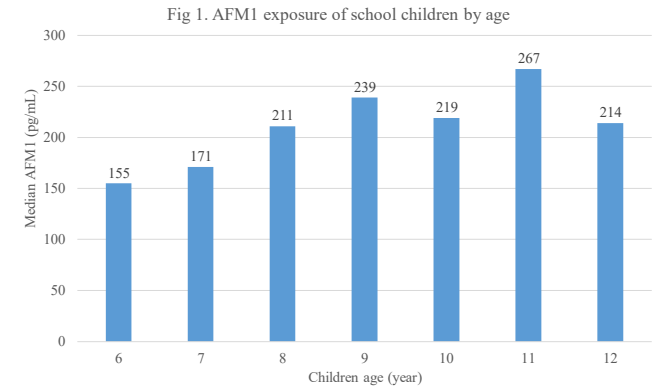
$r = 0.45$ ;  $R^2 = 0.221$

<sup>a</sup> Significant at  $\alpha .001$ ; <sup>b</sup> Significant  $\alpha .01$ ; <sup>c</sup> Significant  $\alpha .05$

<sup>d</sup> Rarely -  $\leq$  once a week, <sup>e</sup> Sometimes - 2 - 3 times a week

<sup>f</sup> Height-for-Age Z-score, <sup>g</sup> Household size, <sup>h</sup> Dietary Diversity Score

<sup>i</sup> Frequency of consumption



## Conclusion

In conclusion results from this study showed a high exposure of AFM1 in school-age children from Shebedino woreda, southern Ethiopia. The relation between AFM1 and dietary intake was analyzed based on self-reported data, hence it is recommended that all of the staple foods, as well as animal feeds in the study area should be assessed for AF contamination in order to take preventive measures. Moreover, because the toxin causes detrimental health problems, assessment of short- and long-term exposure in relation to their health status is warranted.

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