Aflatoxin Contamination of Kenyan Maize Flour and Malted Kenyan and Malawian Grains

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Total aflatoxin concentrations of up to 1020 ppb were found in malted grains from Malawi and Kenya. 29% of the maize flour used as the staple food in the two countries was found to be contaminated.

Key words : Aflatoxin, malted grain, Maize flour

Introduction

The problem caused by fungal growth in food and its subsequent deterioration in quality is receiving serious attention by agriculturalists and food scientists in many countries, both at the national and international levels. Conditions favourable to the growth of moulds (temperature of about 28°C, relative humidity of about 90%) are common in both Malawi and Kenya during the period of agricultural production. This, together with the subsequent poor storage conditions makes it apparent that the Malawian and Kenyan agricultural products are at risk of being contaminated with moulds and hence mycotoxin production. Mold growth and mycotoxin contamination has been reported in different foods from Burundi (Munimbazi and Bullerman 1997) and Kenya (Muraguri et. al, 1978). Among the cereal grains, maize (Zea mays) is the most important and widely consumed staple food crop in Kenya and Malawi. It is mainly ground into flour for making *ugali* in Kenya or *sima* in Malawi. Millet, however, is important in the preparation of uji. Malted maize and finger millet are the main malted grains used in the brewing of the local sweet porridge and beer. Local malt is produced in the home environment where there is almost no control over germination and drying period. Thus the process involved in malting of cereals in the home further exposes the grains to higher risks of contamination with molds and toxins. The possible long term consequences of aflatoxin ingestion are a cause of concern requiring the establishment of a surveillance programme. The objectives of this study were therefore to determine the levels of aflatoxin contamination of maize flour used for making the staple diets (*ugali* and *sima*) as well as malted cereal grains used in brewing sweet porridge and local beer in Malawi and Kenya.

Materials and Methods

Sample collection — Malted maize and finger millet were purchased from four local markets in Lilongwe district of Malawi, and Thika market of Kenya. Maize flour samples were purchased at random from supermarkets, provision stores and open markets in Nairobi. The samples were stored at 4°C until use. The samples from Kenya were tested within one week of collection while those from Malawi were tested within two weeks of

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collection.

Aflatoxin analysis — The standard method of the Association of Analytical Chemist (1996) was used. All foods were tested by the CB method.

Results and Discussion

Aflatoxin B_1 was detected in 86% of the tested malted maize and finger millet samples while aflatoxin B_2 was detected in 46% of the samples (Table 1). Aflatoxin G_1 was detected in 30% of the samples although it was not quantified. The concentrations of the aflatoxins was very high with one sample of the malted maize having as much as 640 ppb aflatoxin B_2 and 480 ppb of aflatoxin B_1 making a total aflatoxin level of 1020 ppb. The highest contamination in the malted millet samples was 260 ppb. The malted maize and millet are used to make local brews which are widely consumed both in Malawi and in Kenya. While this study did not investigate the brews for aflatoxins, chances are that these toxins are passed into the brews unaltered because they are not affected by normal cooking temperatures. Aflatoxins are known to be potent toxins as well as carcinogens (Salunkhe et. al). In Kenya, a number of death cases have been ascribed to the consumption of local brews. In most of these cases it has been reported that the brews may have been contaminated, but the actual contaminants were not identified. While this study does not ascribe all the deaths to the presence of Aflatoxin in the local brews, the levels of contamination of the raw materials studied here indicate that aflatoxins may be contributing significantly. The maize flour samples tested showed various levels of contamination (table 2). Apart from one sample that had 160 ppb., all the others were found to have a total aflatoxin contamination of less than 50 ppb. On the overall, 29% of the samples were found to be contaminated. The minimum aflatoxin-B_1 concentrations allowed for human consumption ranges from 5 to 50 ppb (Morgan and Lee). This level varies from country to country, and for a staple food like maize flour, a level of more than 10 ppb would be considered too high.

Table 1 Aflatoxin concentration in malted maize and finger millet

Sample source	sample code	B_1(ppb)	B_2(ppb)	*G_1(ppb)
Mitundu	Maize 2	40	0	0
	Maize 5	80	Trace	0
	Maize 6	160	80	0
	Maize 7	480	640	+
	Maize 8	40	0	0
	Maize 9	160	0	0
	Maize 11	0	20	+
	Maize 14	480	320	+
	Maize 15	Trace	Trace	0
Lilongwe	Maize 16	40	0	+
kawale	Millet 5	160	0	0
Thika	Millet 2	260	0	0
Thika	Millet 3	120	0	0
Thika	Millet 4	0	0	0
% contamination		86	46	30

* Aflatoxin G1 present (+) but not quantified.

Table 2 Aflatoxin concentration in maize flour

Sample source	Sample code	B_1(ppb)	B_2(ppb)
Nairobi	1	40	0
	2	Trace	Trace
	3	160	Trace
	4	20	0
	5	40	0
	6	0	0
	7	0	20
	8	10	0
	9	Trace	Trace
Thika	20	0	0
	21	0	0
	22	Trace	Trace
	23	0	0
	24	0	0
	26	0	0
	27	0	0
	28	0	0
% contamination		29	

In conclusion, the study shows that malted grains that were obtained from the Lilongwe and Thika markets are a source of great health hazard to the consumer due to the high Aflatoxin concentrations. The contamination of maize flour and other foods in Kenya and Malawi needs constant monitoring.

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ケニヤ産トウモロコシ及び麦芽処理した ケニヤとマラウイ産穀物のアフラトキシンによる汚染

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マラウイ及びケニヤ産の麦芽処理された穀物には総量にして1020 ppb 濃度以上のアフラトキシンが検出された．また，ケニヤ及びマラウイの主食品として用いられているトウモロコシ粉の29％がアフラトキシンで汚染されていることが明らかになった．

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