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Contents

Executive summary

The presence of mycotoxins (aflatoxins, fumonisins and Ochratoxin A) was assessed for a limited number of samples collected from the traditional processors for every version of the processes: between 1 to 6 samples collected for each of the 2 to 4 versions of the processes. A total of 7 to 16 samples were tested for each product.

No mycotoxin presence could be detected in Kenkey and Kishk Sa'eedi samples, but 25% for Gowé and up to 50% of Akpan were contaminated with Aflatoxin at higher than the permissible level. In addition, 25% samples of gowé and one sample of Akpan presented fumonisin at higher concentration than the permissible level.

Aflatoxin level is thus a very important safety risk point for the reengineering of akpan and gowé and the consumption of Gowe from maize in rural areas poses a risk of aflatoxin and fumonisin exposure. These products could not be exported to Europe

Results

For each product, the summary and detailed reports are given in annexes for, Akpan, Gowe, Kenkey, and Kishk Sa'eedi, respectively. The table and figure numbers refer to each annex respectively.

Annex 1 – detailed report for Akpan

The Codex Alimentarius Commission (CAC) maximum permissible level of aflatoxins in ready to eat foods is 10 µg/kg (CAC, 1995). The permissible level is less than 4 µg/kg for total aflatoxin in Europe and less than 2 µg/kg for B1 for cereal products (CE 1181/2006) It is of 200 µg/kg for fumonisins B1 and B2 B2 for maize based food for babies and infants and 400 µg/kg for adults.

Seven samples collected from different producers representing the diversity of technologies for producing akpan were analyzed for aflatoxin and fumonisin levels, the most frequent mycotoxins encountered on sorghum and maize products in tropical countries.

Four products over seven did not comply with Codex level for aflatoxin level and five did not for Europe (Table 1).

One sample has a very high fumonisin content (787 µg/kg), far higher than the permissible level for Europe. It also has very high aflatoxin level.

Aflatoxin level is thus a very important safety risk point for the reengineering of akpan. Thus, consumption of Gowe from maize in rural areas poses a risk of aflatoxin and fumonisin exposure and it could not be exported to Europe

Table 1. Results for chemical safety of akpan

Parameter and unit of measurement	SOP number	Respon-sible partner and lab	Variety/Treatment/Process/Raw material used							
			Sorghum ogi		Sorghum dough		Maize ogi		Maize and sorghum mixed dough	
			Number of samples	Values	Number of samples	Values	Number of samples	Values	Number of samples	Values
Aflatoxins (µg/kg) B1 B1 +B2+G1+G2	R-Biopharm Rhone Ltd. Method Aflaprep IFU (P07.V18). Doc 26.06.12	UAC @ FRI	2	1.3/**8.8** 2.1/**12.0**	1	**11.2** **17.7**	2	0.4/**38.5** 0.7/**47.9**	2	**2.4**/**59.7** 3.1/**66.8**
Furmonisin	R-Biopharm Rhone Ltd. Method Fumoniprep IFU (P31.V4). Doc 1.07.2003	UAC @ FRI	2	3/12	1	74	2	23/59	2	26/**787**

Annex 2 – detailed report for Gowe

The Codex Alimentarius Commission (CAC) maximum permissible level of aflatoxins in ready to eat foods is 10 µg/kg (CAC, 1995). The permissible level is less than 4 µg/kg for total aflatoxin in Europe and less than 2 µg/kg for B1 for cereal products (CE 1181/2006). It is of 200 µg/kg for fumonisins B1 and B2 for maize based food for babies and infants and 400 µg/kg for adults.

Eight samples collected from different producers representing the diversity of technologies for producing gowé were analyzed for aflatoxin and fumonisin levels, the most frequent mycotoxins encountered on sorghum and maize products in tropical countries.

Irrespective of the Gowe samples, aflatoxin B_1 was the main aflatoxin (Table 1). Aflatoxin hazard was important for gowé prepared form maize with two samples (over 5) presenting very high aflatoxin levels (13.4 and 34.5 µg/kg). For these samples, aflatoxins contamination was higher than maximum permissible level defined by the Codex Alimentarius Commission. In addition, three of them have aflatoxin level higher than the recommended level for cereal products in Europe.

One sample had fumonisin level (406 µg/kg) higher than permissible level for adults and one (204 µg/kg) higher than the level for infants.

Thus, consumption of Gowe from maize in rural areas poses a risk of aflatoxin and fumonisin exposure and it could not be exported to Europe.

Table 1.Results for chemical safety of gowé (Group 1)

Parameter and unit of measurement	SOP number	Respon-sible partner and lab	Variety/Treatment/Process/Raw material used							
			Malted and non-malted sorghum		Malted and non-malted maize		Malted and non-malted maize and steam cooking		Sorghum malted and non-malted maize mixed	
			Number of samples	Values	Number of samples	Values	Number of samples	Values	Number of samples	Values
Aflatoxins B1 B1+B2+G1+G2	R-Biopharm Rhone Ltd. Method Aflaprep IFU (P07.V18). Doc 26.06.12	UAC @ CIRAD	3	0.3/0.9/1.8 0.6/1.4/2.4	3	0.6/1.5/**28.6** 1.0/2.3/**34.5**	2	**7.8/15.7** **9.0**/**17.9**	0	
Furmonisin	R-Biopharm Rhone Ltd. Method Fumoniprep IFU (P31.V4). Doc 1.07.2003	UAC @ CIRAD	3	6/9/44	3	37/142/**204**	2	157/**406**		

Annex 3 – detailed report for Kenkey

Results of the mycotoxin analysis of maize, intermediary products and the three types of kenkey are shown in the tables 1 to 3 of D.1.2.6.1. Ochratoxin A was not found in any of these samples mentioned.

Aflatoxins were found (Table 1) in very low concentrations in the raw maize (mean value of 0.57 µg/mg in 3 samples) and on maize husks (mean value of 0.63 µg/mg in 2 samples analysed). In 2 samples of dehulled maize analysed aflatoxins were not detected.

In the intermediary products analysed (Table 2), aflatoxins were found in the sample of the mixture of fermented dough and precooked dough but in very low concentration (0.27 µg/kg) and in the 3 samples of pre-cooked dough.

In the market samples of kenkey collected during the survey (Table 3), aflatoxins were detected in 2 of the 5 samples of Fanti kenkey, 4 out of the 5 samples of Ga kenkey and in none of the 6 samples of white kenkey produced from dehulled maize grains. Dehulling therefore appears to improve the safety of kenkey with regards to mycotoxin contamination. The highest concentration of aflatoxins found in any of the samples was 4.2 µg/mg in one of the Ga kenkey samples. This was still below the Ghana standard for aflatoxins in maize which is 15 ppb but exceeded the EU standard of 4 ppm for cereals.

With regards to aflatoxin content in the kenkey samples, all the products analysed were chemically safe based on the Ghana as well as the Codex standards. However the chemical safety of kenkey will always depend on the level or presence of aflatoxins in the maize used to prepare the kenkey. This in turn will depend on the absence of field infestation of maize with the aflatoxin producing moulds and poor storage conditions which may promote mould growth especially when the moisture content of the grains are above 12 %.

Table 1. Results for chemical safety for raw material used for preparing kenkey (Group 1)

Parameter and unit of measurement	SOP number	Respon-sible partner and lab	Variety/Treatment/Process/Raw material used								
			Whole maize			corn husk			Dehulled maize		
			Number of Samples	Mean	SD		mean	SD	Number of Samples	Mean	SD
Aflatoxins (µg/kg)		FRI@ FRI	3	0.57	0.02	2	0.63		2	N.D	
Ochratoxin A (µg/kg)		FRI @ FRI	3	N.D.		3	N.D		3	N.D.	

N.D. Not Detected

Table 2. Results for chemical safety for intermediate products used for preparing kenkey (Group 1)

Parameter and unit of measurement	SOP number	Respon-sible partner and lab	Variety/Treatment/Process/Raw material used								
			Raw dough			Mixture of precooked + raw dough			Precooked dough		
			Number of Samples	Mean	SD		mean	SD	Number of Samples	Mean	SD
Aflatoxins (µg/kg)		FRI@ FRI	1	N.D		1	0.27		3	3.45	0.12
Ochratoxin A (µg/kg)		FRI @ FRI	1	N.D.		1	N.D		3	N.D	

N.D. Not Detected

Table 3. Results for chemical safety for kenkey (Group 1)

Parameter and unit of measurement	SOP number	Respon-sible partner and lab	Variety/Treatment/Process/Raw material used								
			Fanti-Kenkey			Ga-Kenkey			White-Kenkey		
			Number of Samples	Mean	SD	Number of Samples	Mean	SD	Number of Samples	Mean	SD
Aflatoxins (µg/kg)		FRI@ FRI	5	0.48	0.59	5	2.83	1.32	6	0.11	0.05
Ochratoxin A (µg/kg)		FRI @ FRI	5	N.D.		5	N.D.		6	N.D	

N.D. Not Detected

Annex 4 – detailed report for Kishk Sa'eedi

Seven samples collected in 2011 from different producers representing the diversity of technologies for producing Kishk Sa'eedi (KS) were analyzed for aflatoxin, Ochratoxin A and fumonisin levels.

No mycotoxin was detected in the KS samples collected in 2011 (Table 1) whereas a very high level of yeasts and moulds were counted (deliverable D1.2.5.1).

Table 1. Results for chemical safety of kishk Sa'eedi (Group 1)

Parameter and unit of measurement	SOP number	Respon-sible partner and lab	Variety/Treatment/Process/Raw material used					
			BEITY KS*			SOOKY KS**		
			Number of Samples	Mean	SD	Number of Samples	Mean	SD
Aflatoxins	AOAC 2012	NRC @ NRC	5	ND		2	ND	
Ochratoxin A	AOAC 2012	NRC @ NRC	5	ND		2	ND	
Furmonisin	AOAC 2012	NRC @ NRC	5	ND		2	ND	

* KS homemade, home quality
** KS homemade, commercial quality