

Characterisation of aflatoxins B₁, B₂, G₁, and G₂ in groundnuts and groundnut products

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Abstract

Groundnut and its products are believed to be easily contaminated by aflatoxin B₁, B₂, G₁ and G₂ produced by *Aspergillus flavus*. During the study reported here, samples were collected from different traders (big, medium and small) and processors, during rainy and dry seasons. The moisture contents of groundnut and its products collected during the rainy season were higher than during the dry season. Aflatoxin B₁ was detected in 8 of 15 samples collected during the rainy season, and in 5 samples collected during the dry season. Aflatoxin B₂ was detected in some samples contaminated with aflatoxin B₁. The possibility of aflatoxin contamination was higher among small traders, though big traders cannot guarantee that their products are free from aflatoxin contamination.

Introduction

More than 20 years ago, it was reported that many groundnut-based food products in Indonesia were contaminated by aflatoxins (Muhilal et al. 1970). Although the levels of aflatoxin contamination were greatly reduced due to better postharvest handling, contamination in groundnut and its products still occurs. For example, Shinta et al. (1983) have reported that maize stored in BULOG (Indonesian National Logistic Agency) warehouses was contaminated with aflatoxins at considerable concentrations. Also, Rahayu and Dharmaputra (1985) detected aflatoxin B₁ in maize samples collected from farmers in Lampung, Sumatera.

Aflatoxins are metabolites produced by various moulds especially *Aspergillus flavus* and *A. parasiticus* (Diener and Davis 1969) which is easily proliferated in hot and humid climates such as in Indonesia. Continuous ingestion of foods contaminated with aflatoxins may lead to the development of liver cancer due to the accumulation of aflatoxins in the body.

The chemical structures of aflatoxins have been known for some 30 years. Several types of aflatoxins, namely aflatoxins B₁, B₂, G₁, G₂, M₁, and M₂, are known.

It is thought that the storage systems of large traders are better than those of smaller operators. The prevalence of mould contamination, and hence the production of aflatoxins,

are more likely during rainy seasons, when drying is a common problem. Based on those assumptions this study was undertaken and was focused on only aflatoxins B₁, B₂, G₁, and G₂, which are believed to be the dominant types of aflatoxin found in Indonesian food products.

Materials and Methods

Materials

The samples were raw and processed groundnuts. They were collected from various trades and processors in and around Bogor, West Java and Denpasar, Bali.

Methods

Samples were collected from large, medium and small scale traders and processors. The sample collection was done twice, i.e., during rainy season and during dry season. From each trader or processor, only one sample was collected. Hence, for each season there were 15 samples collected from 15 traders and processors (Table 1).

The samples were collected at the same places for two seasons. All samples were then sent to the laboratory for moisture content measurement and aflatoxin determinations. For aflatoxins determination, the TLC method of Coker et al. (1984) was adopted. For each sample the aflatoxins determination was done twice.

Results and Discussion

Moisture content

All samples collected both during rainy and dry seasons had moisture contents below 10% (Tables 2 and 3), but the moisture contents of the samples collected during the rainy season were higher than those collected during the dry season.

In general, the moisture contents of the samples collected from smaller traders were higher than those collected from larger traders, especially during the dry season. This may indicate that the handling and storage systems of larger traders are better than those of smaller traders. However, as noted in

Table 1. Collection of samples for each season

Type and scale of business	Raw groundnut	Processed groundnut	Total
Large traders	2	2	4
Medium traders	2	—	2
Small traders	4	1	5
Processors	2	2	4
Total	10	5	15

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Table 2. Moisture contents (%) of raw groundnut samples

Type and scale of business		Rainy season	Dry season
Large traders	1	8.0	6.7
	2	6.1	6.1
Medium traders	1	7.0	6.8
	2	7.0	6.2
Small traders	1	7.8	7.5
	2	8.7	7.2
	3	7.2	7.8
	4	9.2	7.9
Processors	1	8.4	7.9
	2	9.1	7.9
Mean		7.8	7.2

Table 3. Moisture contents (%) of processed groundnut samples

Type and scale of business		Rainy season	Dry season
Large traders	1	5.7	3.3
	2	3.0	1.7
Small trader	1	1.6	1.6
Processors	1	2.2	2.0
	2	2.3	2.0
Mean		3.0	2.1

Table 4. Aflatoxins (B₁, B₂, G₁ and G₂) contents (parts per billion) in raw groundnut samples

Type and scale of business		Rainy season				Dry season				
		B ₁	B ₂	G ₁	G ₂	B ₁	B ₂	G ₂	G ₂	B ₁
Large traders	1	2.5	—	—	—	—	—	—	—	—
	2	10.0	—	—	—	—	—	—	—	—
Medium traders	1	—	—	—	—	—	—	—	—	—
	2	—	—	—	—	—	—	—	—	—
Small traders	1	5.0	—	—	—	—	—	—	—	—
	2	2.5	20.0	—	—	2.5	—	—	—	—
	3	5.0	—	—	—	5.0	—	—	—	—
	4	30.0	—	—	—	5.0	25.0	—	—	—
Processors	1	—	—	—	—	—	—	—	—	—
	2	10.0	2.5	—	—	—	—	—	—	—

(—): undetected

Table 5. Aflatoxins (B₁, B₂, G₁ and G₂) contents (parts per billion) in processed groundnut samples

Type and scale of business		Rainy season				Dry season			
		B ₁	B ₂	G ₁	G ₂	B ₁	B ₂	G ₂	G ₂
Large traders	1	—	—	—	—	—	—	—	—
	2	15.0	5.0	—	—	2.5	—	—	—
Small trader	1	—	—	—	—	—	—	—	—
Processors	1	—	—	—	—	—	—	—	—
	2	—	—	—	—	—	—	—	—

(—): undetected

the next section, this does not guarantee that their products will be free from aflatoxins.

Aflatoxins contamination

Among 15 samples collected during the rainy season, 7 contained aflatoxins at various levels, whereas during the dry season there were only 3 samples contaminated by aflatoxins (Tables 4 and 5). The prevalence of aflatoxins contamination was more evident during rainy season when the humidity is quite high. From the data on moisture content it was clear that the prevalence of aflatoxins was positively correlated with the moisture content of the sample. However, the production of aflatoxins is not possible if the moisture content of the substrate is below 10%, the moisture content of the samples at the time of collection. It is possible that some samples contained aflatoxins at the time of arrival at the sample spots.

Aflatoxin B₁ was the dominant type found in the samples from both seasons. Aflatoxins G₁ and G₂ were not detected in any of the samples during both seasons. From the results of this study it is interesting to note that whenever aflatoxin B₂ was detected, aflatoxin B₁ was also present in the samples. This study has revealed that the scale of business does not guarantee the absence of aflatoxins in the products from large operators, as shown in Table 4.

The study also revealed that, in processed products, aflatoxins could still be present. In our samples, aflatoxins were detected even in samples collected from large traders. The traders might have purchased raw groundnut already contaminated by aflatoxins.

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