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Determination of aflatoxin in milk and milk products

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ABSTRACT: The aflatoxin contents of milk and milk products sold for public consumption in Samaru areas of Zaria were analysed. The result showed that the mean aflatoxin M₁ levels in ppb assayed for each sample are as follows: 0.03, 0.02, 0.01 and 0.00 for cow milk, sheep milk, yoghurt and Peak milk respectively. The result obtained in this study is in conformity with the recommendation of World Health Organization Protein Advisory Board since the value obtained is less than the maximum permissible concentration of 0.03 ppm for undernourished children.

INTRODUCTION

Aflatoxins are a group of chemically related compounds which are derivatives of difuranocoumarin. The discovery of these compounds as contaminants of animal feeds coupled with the acute toxicity and potent carcinogenic effect of the fluorescent metabolites on various biological systems of most animal species, stimulated research on their effect on very active organs like the liver and kidney (1). Aflatoxins have been implicated as causative agents of primary liver carcinoma (2). A survey of both frequency and amount of aflatoxin contamination of food in Uganda showed that the distribution of aflatoxin in food stored for consumption correlated with the pattern of incidence of liver cancer, since aflatoxin contamination was highest in areas with the highest incidence of the disease (3).

Apart from being hepatotoxic and hepatocarcinogenic, they have been shown to produce degenerative changes in renal tubular epithelium, kidney tumours, especially abnormal mitosis in the actively dividing cells of the lymph node, thymus and various regions of the gastrointestinal tract (4).

Aflatoxin B₁ has been shown to be the most potent carcinogen. It is known to suppress DNA and RNA synthesis probably by inhibiting RNA polymerase (5). It also suppresses protein synthesis probably by its action on RNA, and causes mitotic arrest in experimental animals (6).

Dairy cows fed moderately on high levels of aflatoxin B₁ in their rations excreted detectable amounts of an aflatoxin metabolite, aflatoxin M₁, in their milk (7). Aflatoxin M₁, like aflatoxin B₁, causes liver lesions in experimental animals. The presence of aflatoxin M₁ in milk presents a hazard to humans who drink the milk and particularly to infants since the young of most species have the greatest susceptibility to aflatoxin (8). The concentration of aflatoxin in the milk depends on the quantity of aflatoxin ingested and the time elapsing between ingestion and milk collection (9).

MATERIALS AND METHODS

The cow and sheep milk were obtained from Fulani sellers at Samaru market, while the milk products (yoghurt and Peak) were purchased at Kowa Store, Samaru, Zaria. Velasco fluorotoxin meter and fluorotoxin kits were products of Neotec Instruments Inc., Silver Spring, Maryland. All other reagents were of analytical grade.

Extraction and detection

The pigment in the samples were first removed using ferric gel and then filtered. The filtrate obtained was used in extracting aflatoxin using chloroform:methanol (96:4 v/v) as described earlier (11). The extract obtained was detected using standard chromatographic techniques.

Measurement of aflatoxin

The aflatoxin content of each sample was measured using Velasco fluorotoxin meter. A standard, 20 ppb, and a blank microcolumn were used in calibrating the meter before inserting the sample microcolumn.

RESULTS AND DISCUSSION

Milk as the animal product most commonly found to be contaminated with mycotoxin has been reported to support the growth of strains of *Aspergillus* which produces aflatoxin, especially condensed and powdered milk (10).

The results presented in Table 1 show clearly that the total aflatoxin levels of cow milk is the highest, followed by sheep while Yoghourt and Peak milk have the least. The high concentration for cow and sheep might be attributed to their feeding on contaminated rations and probably as a result of their poor storage conditions, while the low levels of yoghurt and Peak milk might be due to good processing and storage conditions.

Furthermore, among the different aflatoxins tested, aflatoxin M₁ has the highest concentration which is a good indication of the presence of aflatoxin B₁ in the feed (11). Since significant level of aflatoxins are contained in samples which may constitute health hazards, it is strongly suggested that similar studies be conducted at different times

of the year for a comprehensive picture of possible toxin intake and its effects.

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Table 1: Aflatoxin content of milk and milk products (ppb)

Aflatoxin present	Sample assayed*			
	Cow milk (nono)	Sheep milk	Yoghourt	Peak milk
B1	0.01	0.01	0.01	0.01
G1	0.01	0.00	0.00	0.00
M1	0.03	0.02	0.01	0.00
M2	0.01	0.01	0.00	0.00
Total	0.06	0.04	0.02	0.01

*The number of sample assayed in each milk was 2.