Effect of Tortilla-Preparation Process on Aflatoxins B\textsubscript{1} and B\textsubscript{2} in Corn

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Abstract

Naturally contaminated corn containing 450 and 54 ppb aflatoxins B\textsubscript{1} and B\textsubscript{2}, respectively was treated with Ca(OH)\textsubscript{2} for making tortillas. The cleaned corn and tortillas were analyzed for aflatoxins B\textsubscript{1} and B\textsubscript{2} by high performance liquid chromatography (HPLC) and confirmed by thin layer chromatography (TLC). The average concentrations of aflatoxins B\textsubscript{1} and B\textsubscript{2} in the final products (tortillas) were only 40\% and 28\% lower than that in starting materials (corn kernels), respectively. Aflatoxins G\textsubscript{1} and G\textsubscript{2} were not detected in either corn or tortilla samples.

Introduction

In spite of the great importance of maize (Zea mays L.) as the principal food in the daily diet in the form of tortillas for many people in Mexico, Central America, and other areas of Latin-America, relatively few studies have been made of the retention of aflatoxin mycotoxins in tortillas made from maize naturally contaminated with aflatoxin. Mycotoxins have recently been discovered in many new areas of the world in grains and foodstuffs (1, 2, 4, 13). Lately research has been directed toward the retention of mycotoxins during grain processing. Abbas et al (2) reported varying concentrations of DON in wheat, in various milling fractions, and in bread. They also observed that cleaning, milling, and baking did not remove all DON from the finished product. Abbas et al (3) reported that the process of tortilla manufacture
was effective in removing toxins from tortillas naturally or artificially contaminated with *Fusarium* toxins (zearalenone, DON, and 15-ADON). Price and Jorgensen (6) and Ulloa-Sosa and Schroeder (11) reported that tortilla manufacture was not totally effective in removing aflatoxin B₁ from tortillas made with naturally contaminated corn.

The purpose of the present paper was to determine the effect of domestic tortilla preparation in Mexico on the fate of aflatoxins B₁ and B₂ in tortillas made from naturally contaminated yellow corn.

**Methods**

**Apparatus**

(a) High performance liquid chromatography (HPLC). Model RF 530 fluorescence detector for aflatoxins B₁ and B₂ with variable wave lengths 365 nm excitation and 440 nm emission flow cell (Shimadzu, Columbia, MD).

(b) Liquid chromatographic column—Zorbax reverse phase C₁₈ 4.6 mm id x 25 cm, particle size 55 – 105 microns (Dupont, Wilmington, DE).

(c) Thin Layer Chromatography (TLC) - prepared silica gel plates (E Merck, Darmstadt, West Germany).

**Source of Corn Sample**

In 1985, a 1kg sample of naturally aflatoxin-contaminated yellow corn was obtained from Dr David M Wilson, Department of Plant Pathology, Coastal Plain Experiment Station, Tifton, GA 31793.

**Reference Standards**

Aflatoxins B₁, B₂, G₁ and G₂ were purchased in analytically pure form from the Myco-Lab Co, PO Box 321, Chesterfield, MO.

**Preparation of Tortillas**

The domestic method of tortilla preparation in Mexico was used as follows: The corn sample was cleaned by manual removal of the foreign material. It was mixed well and representative 300 gram samples were obtained. Each sample was divided into five 60 gram samples and 30 g out of each 60 g samples were taken to be extracted directly for the presence of aflatoxins B₁, B₂, G₁ and G₂ before making tortillas. The remaining 30 g of the sample were used to prepare tortillas as follows: 30 g corn was placed in a 250 mL flask. A solution of 2 % Ca(OH)₂ was added to flask containing corn to cover the corn totally. The flask with its contents was boiled for 5 min while stirring and allowed to soak overnight (12 hr). Alkali-treated corn was rinsed thoroughly with distilled water and ground with a coffee grinder. The dough (30 g) was made into one tortilla and cooked on a flat plate at 110 – 120°C for approximately 7 or 8 min on each side. The cooked tortillas were weighed, then allowed to air dry in a ventilated hood for 3 days and reweighed. Samples of corn and dried tortillas were ground and divided into subsamples for subsequent analyses.

**Aflatoxin Analyses**

8 or 10 grams of samples of corn or tortilla were extracted and analyzed by the method as described in detail by JW DeVries and HL Chang (7).