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MYCOTOXINS IN FOODSTUFFS. XI. FATE OF AFLATOXIN B_1 DURING PREPARATION AND BAKING OF WHOLE-MEAL WHEAT BREAD

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ABSTRACT

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The fate of aflatoxin B_1 in baking was investigated by adding the crystalline toxin to the dough of whole-meal wheat bread (54% whole-meal wheat, 2% yeast, 1% sodium chloride, 43% water) at levels of 10.8 and 5.4 μg/g. About 10–20% of the added toxin was found in the final dough. Subsequent baking (120°C, 30 min) did not reduce the amount of the aflatoxin B_1.

Aflatoxin-producing fungi are ubiquitous and may grow in cereals (1). However rigorous the control procedure, eliminating contamination of flour and whole meal with aflatoxins is not possible. If these toxins were present in bread prepared from these products, such foodstuffs could be a danger to health. Aflatoxin B_1 in peanut oil, oilseed meals, and contaminated peanuts and pecans is known to be stable up to temperatures of 100°C, but is partially destroyed at higher temperatures (2–6). In the process of baking, a temperature of approximately 100°C is reached in the center of the bread. This would result at best in a slight inactivation of the toxin. Volatile carboxylic acids that are present in bread, however, may interact with aflatoxin B_1 (7). Hence, the acids that had become volatile at the relatively low baking temperature appeared capable of degrading aflatoxin B_1 in bread.

Results of studies of the behavior of aflatoxin B_1 in baking are presented in this article.

MATERIALS AND METHODS

One milligram of aflatoxin B_1 (Serva, Heidelberg, Germany) was dissolved in 10 ml of chloroform; 5 ml of this solution was added to 20 g of whole-meal wheat. This mixture was stirred until the solvent had evaporated; subsequently, 30 g of whole-meal wheat, 2 g of baker's yeast, 1 g of sodium chloride, and 40 g of water were added. After thorough mixing (5 min), the dough stood for 30 min to allow the mixture to rise. It was then baked for 30 min at 120°C. Thin-layer

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TABLE I
Fate of Aflatoxin B_1 in Preparing Whole Wheat Bread

Experiment No.	Whole-meal Wheat		Dough		Bread
	Aflatoxin B_1 (μg/g)	Toxin Recovered (%)	Aflatoxin B_1 (μg/g)	Toxin Recovered (%)	Toxin Recovered (%)
1	20	66	10.8	20	20
2	20	50	10.8	20	20
3	20	45	10.8	20	20
4	10	40	5.4	10	10
5	10	40	5.4	15	15

chromatography (tlc) analysis of aflatoxin B_1 in the interior of the bread and the semiquantitative determination were performed as described elsewhere (8).

RESULTS AND DISCUSSION

The recovery of aflatoxin B_1 in the whole-meal wheat, dough, and final bread is summarized in Table I. The results demonstrate that recovery of the added toxin was greatly reduced during preparation of the dough. This observation confirms the results of Jemmali and Lafont (9), who observed a significant decrease of the aflatoxin B_1 content in the course of kneading in preparing white bread from flour containing the toxin. One can assume that the degradation of the aflatoxin B_1 during kneading is caused by oxidative or hydrolytic processes or both (2,9).

In baking, however, the remaining aflatoxin content is only insignificantly reduced. The low baking temperature as well as the obviously low amounts of volatile acids (10) in the bread itself do not degrade the aflatoxin B_1 to any mentionable extent. Jemmali and Lafont (9) describe similar results.

The results of this study show the risks of using contaminated whole-meal wheat in preparing bread. Particular care must be taken to ensure that the raw materials for preparing bread are free from molds and thus free from mycotoxins.

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