

## MICROBIOLOGICAL TOXINS

### REDUCTION OF FUMONISIN BIOAVAILABILITY BY NIXTAMALIZATION: EVIDENCE FOR FUMONISIN-CORN MATRIX INTERACTIONS

(K. A. Voss, T. D. Burns, M. E. Snook, and R. T. Riley)

Nixtamalization is the traditional method for making masa and tortillas. It involves cooking and steeping corn in alkaline water. Nixtamalization reduces the concentration of the mycotoxin fumonisin B<sub>1</sub> (FB<sub>1</sub>) in foods, however, the amount of reduction can be overestimated and potential toxicity underestimated if undetectable FB<sub>1</sub>-corn matrix binding occurs or unknown FB<sub>1</sub> degradation products form. A bioassay-based approach was therefore used to determine how nixtamalization affects toxicity and fumonisin bioavailability. *Fusarium verticillioides* culture material (CM) was nixtamalized as is (NCM) or after mixing with ground corn (NCMC). CM equivalents of uncooked CM, NCM and NCMC were fed to rats and (a) toxicity assessed by microscopic examination of the kidneys and (b) bioavailability evaluated by quantification of the fumonisin biomarkers sphinganine and its 1-phosphate metabolite in the kidneys. Nixtamalization significantly reduced the bioavailability and toxicity of FB<sub>1</sub> in the diets significantly. However, the presence of corn matrix during nixtamalization reduced toxicity and bioavailability to a significantly greater extent, so that the appearance and biomarker concentrations of the kidneys did not differ from rats fed uncontaminated control diet. The bioassay results were correlated with the amount of FB<sub>1</sub> found in the diets by chemical analysis. Together, the results of this experimental model show that FB<sub>1</sub> potentially interacts with corn matrix during nixtamalization in a manner that reduces fumonisin bioavailability.

### DETECTION OF MATRIX-BOUND FUMONISINS IN NIXTAMALIZED CORN

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Fumonisin mycotoxins are found in corn and corn-based foods, including those cooked by nixtamalization. This process involves cooking and steeping corn in an alkaline solution and reduces the amount of fumonisins found in the product. However, emerging evidence suggests that fumonisins might bind to food matrix components during cooking and, as a result, standard quantification methods may underestimate fumonisin concentrations. The concentrations of free (unbound) FB<sub>1</sub> and its hydrolysis product HFB<sub>1</sub> in raw and nixtamalized corn kernels were measured using standard quantification methods. Thereafter, protein-bound and residual (nonprotein)-bound fumonisins (FB<sub>1</sub> plus HFB<sub>1</sub>; detected as HFB<sub>1</sub>) concentrations in the uncooked and cooked kernels were compared using a modification of the analytical method for "hidden fumonisins" developed by Park et al. (*Food Addit. Contam.* 21: 1168-1178, 2004). The concentration of protein bound fumonisins found in the nixtamalized kernels was 5 to 6-fold greater than in the uncooked kernels. Residual-bound fumonisin was also present at higher concentrations (about 15 fold) in the nixtamalized than in the uncooked kernels. These observations indicate that fumonisin-matrix binding does occur during nixtamalization. However, the amount of matrix-bound fumonisins in the nixtamalized kernels was relatively low and accounted for less than five percent of the total fumonisins in the uncooked kernels.