

MICROBIOLOGICAL TOXINS

EFFECT OF EXTRUSION COOKING, WITH AND WITHOUT ADDED GLUCOSE, ON FUMONISIN B₁ IN CORN GRITS

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Extrusion cooking reduces fumonisin concentrations in corn but how it affects fumonisin toxicity is not well characterized. A batch of corn grits (SG) was spiked with fumonisin B₁ (FB₁) and two batches (FG1 & FG2) were contaminated with FB₁ by fermentation. Respective FB₁ concentrations of SG, FG1 and FG2 were 43, 46, and 67 nmol/g (dry weight). SG, FG1 and FG2 were then extruded both with and without glucose supplementation (10% w/w). FB₁ concentrations of the extruded products E-SG, E-FG1, and E-FG2 were 34 (21% reduction), 29 (37% reduction), and 51 nmol/g (24% reduction). Supplementation with glucose further decreased FB₁ concentrations of the cooked materials: respective FB₁ concentrations of E-SG plus glucose, E-FG1 plus glucose and E-FG2 plus glucose extrusion products were 9.8 (77% reduction), 5.9 (87% reduction), and 12 nmol/g (83% reduction), respectively. Significant amounts (20-38 nmol/g) of the FB₁-glucose reaction product, N-(deoxy-D-fructos-1-yl) FB₁ were found only in the glucose-supplemented products. For toxicity studies, SG, FG1 or FG2 (50% w/w) and equivalent weights of each extruded product were fed to male rats for three weeks. Two control groups were fed (50% w/w) uncooked or extruded uncontaminated grits. Relative kidney weights of rats fed E-FG1 plus glucose (0.83%) were similar to control values (0.79-0.82%) and greater than those found in all other test groups (0.72-0.76%). Histopathology revealed the presence of kidney lesions consistent with FB₁ exposure in all groups except the controls. Lesions found in rats fed E-FG1 plus glucose were less severe than those from the FG1 or E-FG1 groups. However, extrusion with or without glucose supplementation did not affect the severity of kidney lesions induced by SG or FG2. Together, these findings confirmed that extrusion with glucose supplementation significantly reduces the amount of measurable FB₁ in contaminated corn grits (>75%) but that more studies are needed to determine its affect on toxicity.

TOXICITY OF FUMONISIN-CONTAMINATED FUNGAL CULTURES NIXTAMALIZED IN THE PRESENCE AND ABSENCE OF CORN MATRIX

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Cooking-steeping corn in alkaline water (nixtamalization) reduces the amount of detectable fumonisin B₁ (FB₁) in masa and tortilla products. However, reductions might be overestimated if FB₁ reacts with the corn matrix to form undetectable reaction products. The purpose of this study was to investigate if corn matrix facilitates reduction of measurable FB₁ during nixtamalization and reduces the toxicity of the cooked material. *Fusarium verticillioides* culture material (CM) was nixtamalized in the absence (NCM) and presence (NCMC) of ground uncontaminated corn. Sham nixtamalization (cooking-steeping in non-alkaline water) of the CM without (SCM) and with corn (SCMC) was also done. Equivalent weights of each material were added to rodent diet and fed to male SD rats for 1 (n=3/group) or 3 weeks (n=5/group) to evaluate toxicity. Control groups were fed chow plus uncontaminated corn (UC), chow plus nixtamalized uncontaminated corn (NUC), or uncooked CM. FB₁ concentrations of the diets were: UC = 0.15, NUC = 0.16, CM = 9.08, NCM = 2.08, NCMC = 0.49, SCM = 1.19 and SCMC = 0.95 ppm. Hydrolyzed FB₁ concentrations were: UC = 0.07, NUC = 0.09, CM = 0.25, NCM = 1.27, NCMC = 1.60, SCM = 0.55 and SCMC = 0.37 ppm. No differences in body weights, food consumption or relative kidney weights were found during the feeding study. Apoptotic kidney lesions typically found as an effect of fumonisins were found in all groups except the UC and NUC controls. Compared to the rats fed CM (mean apoptotic cell counts at week 3 = 207 ± 105 (SD)), fewer apoptotic renal epithelial cells were found in the kidneys from the other groups. Furthermore, apoptosis counts in the NCMC group (22 ± 8) were less than those of the NCM group (44 ± 12). Apoptosis counts of the SCM and SCMC groups were similar, averaging 17 ± 5 and 19 ± 6. These findings suggest that the corn matrix facilitated reduction of measurable FB₁, possibly through matrix binding, and further reduced toxicity of nixtamalized CM.