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Research Paper

Occurrence of Ochratoxin A in Infant Foods in the United States

JACK CAPPOZZO,[1] LAUREN JACKSON,[2]* HYUN JUNG LEE,[3] WEI ZHOU,[1] FADWA AL-TAHER,[1] JERRY ZWEIGENBAUM,[4] AND DOJIN RYU[3]*

[1]Illinois Institute of Technology and [2]U.S. Food and Drug Administration, Institute for Food Safety and Health, 6502 S. Archer Road, Bedford Park, Illinois 60501; [3]School of Food Science, University of Idaho, 875 Perimeter Drive MS 2312, Moscow, Idaho 83844-2312; and [4]Agilent Technologies, Inc., 2850 Centerville Road, Wilmington, Delaware 19808, USA

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ABSTRACT

Ochratoxin A (OTA) is a possible human carcinogen and occurs frequently in cereal grain, soy, and other agricultural commodities. Infants and young children may be more susceptible to contaminants than adults because of their lower body weight, higher metabolic rate, reduced ability to detoxify food toxicants, and more restricted diet. The purpose of this study was to investigate the occurrence and levels of OTA in infant formula and infant cereal products available in the U.S. market. In the present study, 98 powdered infant formula (milk- and soy-based) samples and 155 infant cereal (barley-, rice-, oat-, wheat-, and mixed grain–based) products were collected from different retail locations in the United States over a 2-year period. OTA levels were determined by liquid chromatography–tandem mass spectrometry. Although OTA was not detected in any of the infant formula samples, 47 (30%) of 155 infant cereals were contaminated with OTA in the range of 0.6 to 22.1 ng/g. At present, there is no regulatory limit for OTA in the United States. However, all of the positive samples were above the maximum level set by the European Commission (0.5 ng/g) for OTA in baby foods. OTA was detected in all types of infant cereals, but the highest incidence and concentrations were found in oat-based infant cereals (59%), followed by mixed grain cereals (34%). Increased surveillance and monitoring of OTA levels in grains used in infant foods may be needed to reduce exposure of infants and young children to OTA from cereal products.

Key words: Food safety; Infant cereal; Infant formula; Mycotoxins

Mycotoxins are toxic contaminants produced by filamentous fungi that can be found in various agricultural commodities and derived foodstuffs. Ochratoxin A (OTA) (Fig. 1), a mycotoxin produced primarily by *Penicillium verrucosum* and *Aspergillus ochraceous,* is one of the most common mycotoxin contaminants in cereals such as wheat, barley, and oat, and foods derived from them *(25, 45)*. OTA also has been found in coffee, cocoa, beer, wine, grape juice, dried fruit, spices, soy, and nuts *(1, 3, 48)*. The toxin can also be present in meat and milk products due to exposure of animals to contaminated feed, although at significantly lower concentrations than in cereals *(13, 47, 48)*.

OTA has been shown to be nephrotoxic on the basis of experimental animal studies *(29, 39)*; thus, it has been classified as a possible human carcinogen (Group 2B) by the International Agency for Research on Cancer *(22)*. In addition, OTA has been shown to be hepatotoxic, teratogenic, neurotoxic, and immunosuppressive to several experimental animals *(12, 20, 31, 35, 36)*. Based on the toxicological data, the Joint Food and Agriculture Organization of the United Nations, World Health Organization Expert Committee on Food Additives (JECFA) and the European Food Safety Authority (EFSA) Scientific Panel on Contaminants in the Food Chain (CONTAM) established provisional tolerable weekly intake (PTWI) values of 100 ng OTA per kg of body weight and 120 ng OTA per kg of body weight, respectively *(18, 24)*.

Although OTA is known to contaminate a wide range of agricultural commodities *(14)*, cereals are a major contributor of OTA to the diet in Europe, Canada, and other geographical regions *(7)*. Cereals contribute 75% of estimated dietary exposure to OTA for children 1 year of age in Canada *(30)*. In many countries, cereals such as barley, oat, rice, and wheat are introduced as the first solid foods for infants *(9)* to support nutrition and to partially replace breast milk or infant formula in the diet *(16, 19)*. Infant formulas, which are primarily cow's milk or soy based, have also been shown to contain OTA *(8, 47)*. Thus, infant formula may serve as another source of exposure of infants to OTA. Infants may be more vulnerable to the toxic effects of mycotoxins than adults, because of their lower body weight, higher metabolic rate, reduced ability to detoxify food toxicants, and more restricted diet *(5, 46)*.

Because of the possible risk associated with OTA consumption by infants, several countries have set regulatory limits for OTA in foods for infants and young children. The European Commission *(17)* has set the maximum level of OTA at 0.5 ng/g for processed cereal-based foods and

* Authors for correspondence. Tel: 708-924-0616; Fax: 708-924-0690; E-mail: lauren.jackson@fda.hhs.gov (L.J.). Tel: 208-885-0166; Fax: 208-885-2567; E-mail: dryu@uidaho.edu (D.R.).

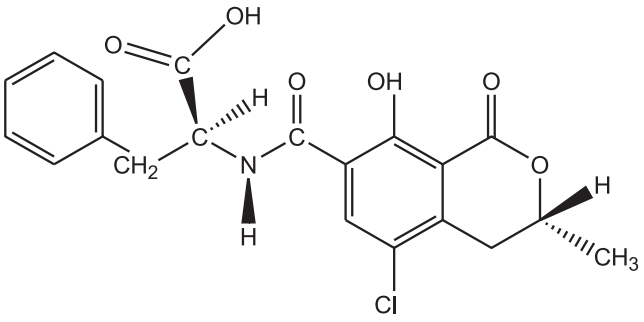

FIGURE 1. *Structure of ochratoxin A.*

foods for infants and young children. Although the United States and Canada currently have not established limits for OTA, a maximum limit for OTA of 0.5 ng/g in infant formulas and cereal-based foods and foods for young children has been proposed by Heath Canada *(21)*.

Numerous studies have evaluated the OTA content of infant foods such as cookies, crackers, teething biscuits, cereals, and infant formula products purchased in Russia *(2)*, European countries *(5, 6, 8–10, 26–28, 47)*, and Canada *(30, 33)*. However, information is limited on levels of the toxin in infant foods purchased in the United States, although surveys have been done on OTA levels in other foods and beverages available in the United States *(32, 34, 40, 42)*. The aim of this study was to determine the incidence and levels of OTA in several infant foods available in the U.S. market. These foods included milk- and soy-based infant formulas and infant cereals formulated with different types of grain (barley, rice, oat, wheat, and mixed grain). An analytical method based on liquid chromatography–tandem mass spectrometry (LC-MS/MS) was used to detect and quantify OTA in samples.

MATERIALS AND METHODS

Sampling. Commercially available powdered infant formula (soy- and milk-based) products and infant cereals (rice, barley, oat, wheat, and mixed grain) were purchased from local retail markets across the United States over two separate years (2012, first year; 2013 to 2014, second year). For products sampled for the first year (2012), sampling locations included Chicago (IL), Fargo (ND), Minneapolis (MN), Lincoln (NE), San Francisco (CA), and Dallas (TX). Samples for the second year were obtained from the same locations except Moscow (ID) and East Lansing (MI) were included instead of Dallas (TX). Infant formula and infant cereals included conventional and organic products. In total, 98 (57, first year; 41, second year) samples of infant formula, including 53 milk- and 45 soy-based products, were obtained and analyzed for OTA. Infant cereals (total of 155) included in the survey were barley- ($n = 9$), rice- ($n = 54$), oat- ($n = 51$), wheat- ($n = 6$) and mixed grain–based ($n = 35$) products. Collected samples were stored at –20°C in 1-kg plastic bags until analysis. Each sample was thoroughly mixed before removal of the analytical portions.

Preparation of OTA standard solutions. Solid, unlabeled OTA (5 mg) was purchased from Sigma (St. Louis, MO), and the internal standard [^{13}C]OTA (10 μg/ml in acetonitrile) was from Romer Labs (Vienna, Austria). A 10-μg/ml stock solution of the unlabeled OTA stock solution was prepared in 5 ml of acetonitrile (Fisher Scientific, Hanover Park, IL). A solution containing the ^{13}C-labeled analogue was prepared as another stock solution in 1 ml of acetonitrile-water (30:70, vol/vol). A 1,250-ng/ml working solution of the unlabeled OTA was made, and dilutions were prepared at the following concentrations: 0.125, 0.625, 1.25, 6.25, 12.5, 62.5, and 125 ng/ml. For preparation of calibration standards, 80 μl of the standard solutions was transferred into high-performance liquid chromatography (HPLC) vials with microinserts (VWR International, Batavia, IL), and 20 μl of the ^{13}C-labeled stock solution mixture was added. An OTA calibration curve was prepared with standard concentrations of 0.1, 0.5, 1, 5, 10, 50, and 100 ng/ml. The internal standard solutions had a final [^{13}C]OTA concentration of 20 ng/ml. All stock and working standard solutions were stored in amber vials at –20°C until analysis.

OTA analysis by LC-MS/MS. The LC-MS/MS method developed by Al-Taher et al. *(4)* was used to analyze infant cereal and infant formula samples for OTA. A brief description of the method is as follows. Five grams of each infant formula and infant cereal sample was combined with 20 ml of acetonitrile–water–formic acid (80:19.9:0.1, vol/vol/vol), and the mixture was shaken on a horizontal Burrell wrist action shaker (Burrell Scientific, Pittsburgh, PA) for 60 min at room temperature. An AG centrifuge (Eppendorf, Hamburg, Germany) was used to centrifuge the extract for 5 min at 1,478 × *g*. An aliquot (80 μl) of the supernatant fluid was transferred into an HPLC vial with a microinsert (VWR International), and 20 μl of the ^{13}C-labeled working OTA solution was added. All cereals and infant formula samples were analyzed in triplicate.

An 1290 Infinity HPLC system equipped with a Zorbax Eclipse Plus C18 column (100 by 2.1 mm, 1.8 μm; Agilent Technologies, Inc., Wilmington, DE) was used for chromatographic separation of the OTA in sample extracts. Mobile phase A was composed of 0.1% formic acid in water, and mobile phase B was made up of 0.1% formic acid in methanol; both mobile phases contained 5 mM ammonium formate. The column temperature was kept at 35°C and the flow rate was 0.3 ml/min. The gradient conditions were as follows: initial time, 30% B; 0.5 min, 30% B; 8 min, 100% B; 10 min, 100% B; and reequilibration to 12 min. OTA was detected and quantified using a 6460 Triple Quadrupole LC-MS/MS with Jet Stream Technology (Agilent Technologies, Inc.). OTA was identified by dynamic multireaction monitoring in positive electrospray ionization mode. The gas temperature was 300°C and the flow rate was 10 liters/min. The nebulizer was set at 45 lb/in^2, and sheath gas temperature and flow rate were 350°C and 11 liters/min, respectively. The capillary and nozzle voltages were 3,500 and 0 V, respectively. The selected reaction monitoring transitions, fragmentor, and collision energies were selected as follows: for unlabeled OTA, m/z 404.1 → 358, 239, and 193 (fragmentor of 140 V, collision energy of 8, 25, and 45 V, respectively); and for [^{13}C]OTA, m/z 424.2 → 250.2 (fragmentor of 120 V, collision energy of 24 V). OTA identification and quantitative analysis were performed with MassHunter Quantitative Analysis software version B.04.00 (Agilent Technologies, Inc.).

To evaluate the recovery of OTA in the infant formula and cereal matrices, an external standard method was used. A dilution of 1 to 5 was made by mixing 20 μl of the spiked sample with 80 μl of the acetonitrile–water solvent mixture (30:70, vol/vol) in an HPLC vial containing a microinsert. Three replicates were prepared for each of the samples. For external standard calibration, unlabeled OTA was prepared at the following concentrations: 0.05, 0.1, 0.5, 1, 5, 10, 50, and 100 ng/ml. The limit of detection (LOD) for OTA in infant formulas was 0.1 ng/g and the limit of quantification (LOQ) was 0.25 ng/g. For infant cereals, the LOD and LOQ were 0.1 and 0.5 ng/g, respectively. In addition, the mean recoveries for spiked samples ranged from 79 to 123%.

TABLE 1. *Occurrence of ochratoxin A (OTA) in infant formula products collected in the United States*

		2012 (first year)			2013–2014 (second year)		
Culture type	Main ingredient	Incidence (%)	Mean ± SD (ng/g)[a]	Range (ng/g)	Incidence (%)	Mean ± SD (ng/g)	Range (ng/g)
Conventional	Milk	0/10 (0)	—[b]	—	0/18 (0)	—	—
	Soy	0/10 (0)	—	—	0/19 (0)	—	—
	Total	0/20 (0)	—	—	0/37 (0)	—	—
Organic	Milk	0/14 (0)	—	—	0/11 (0)	—	—
	Soy	0/7 (0)	—	—	0/9 (0)	—	—
	Total	0/21 (0)	—	—	0/20 (0)	—	—
Overall		0/41 (0)	—	—	0/57 (0)	—	—

[a] Mean ± SD of concentrations in positive samples (>LOQ or 0.25 ng/g).
[b] —, no positive samples were detected.

Statistical analyses. Statistical analyses were performed using the Statistical Package for Social Science version 12.0 (SPSS Inc., Chicago, IL). Significant differences were determined using unpaired Student's *t* tests at a significance level of $P < 0.05$. All results were reported as means ± standard deviations (SD).

RESULTS AND DISCUSSION

Infant formulas. The results of the OTA analysis of 98 commercial milk- and soy-based infant formula samples obtained in the United States over a 2-year period are summarized in Table 1. OTA was not detected in any of the infant formulas analyzed in this study (LOQ = 0.25 ng/g). Similar results were reported by Skaug *(47)* who could not detect OTA in Norwegian infant formula samples. However, OTA was reported to contaminate infant formula products obtained in countries outside the United States. In a Canadian study, Kuiper-Goodman et al. *(30)* reported a low frequency (15%) of contamination of soy-based infant formulas, and the mean level of contamination in these products was 0.04 ng/g. Similar results were reported for milk-based formula products from Turkey. According to Baydar et al. *(8)*, 7 (24%) of 29 samples of milk-based infant formulas from Turkey were contaminated with OTA, with a mean concentration of 0.50 ng/g in positive samples. In a more recent survey of products from Turkey, 12 (19%) of 62 samples of infant formulas were contaminated with OTA, with concentration ranging from 0.017 to 0.184 ng/g and with a mean concentration of 0.103 ng/g in contaminated samples *(28)*. Higher rates of contamination were observed in infant formulas purchased in Italy and Portugal. Meucci et al. *(37)* reported that 133 (72%) of 185 infant formula samples from Italy were contaminated with OTA, and levels of contamination were between 0.04 and 0.69 ng/g. In Portugal, Alvito et al. *(5)* collected and analyzed one soy- and six milk-based infant formulas. OTA was detected in the soy-based infant formulas (0.136 ng/g) and one of six milk-based infant formula (0.135 ng/g) products. Overall, our survey results and those from other studies suggest that infant formula products typically have a low level of contamination with OTA; thus, they likely do not contribute substantially to exposure of infants to the toxin.

Infant cereals. In total, 155 infant cereal samples, 64 from 2012 (first year) and 91 from 2013 to 2014 (second

TABLE 2. *Occurrence of ochratoxin A (OTA) in infant cereals collected in the United States*

		2012 (first year)[a]			2013–2014 (second year)		
Culture type	Main ingredient	Incidence (%)	Mean ± SD (ng/g)[b]	Range (ng/g)	Incidence (%)	Mean ± SD (ng/g)	Range (ng/g)
Conventional	Barley	1/7 (14)	14.4	—[c]	0/1 (0)	—	—
	Rice	1/9 (11)	1.4	—	0/18 (0)	—	—
	Oat	5/9 (56)	6.4 ± 3.7	2.0–11.8	14/17 (82)	7.3 ± 7.0	1.1–22.1
	Wheat	—	—	—	0/3 (0)	—	—
	Mixed grain	2/8 (25)	2.1 ± 0.8	1.6–2.7	6/13 (46)	3.0 ± 1.9	1.4–5.9
	Total	9/33 (27)	5.8 ± 4.7	1.4–14.4	20/52 (38)	6.0 ± 6.2	1.1–22.1
Organic	Barley	0/1 (0)	—	—	—	—	—
	Rice	1/11 (9)	1.4	—	0/16 (0)	—	—
	Oat	6/11 (55)	2.1 ± 1.6	0.6–4.1	5/14 (36)	5.4 ± 5.2	0.6–13.8
	Wheat	—	—	—	2/3 (67)	1.2 ± 0.0	1.2–1.2
	Mixed grain	3/8 (38)	1.7 ± 0.7	1.0–2.4	1/6 (17)	4.3	4.3
	Total	10/31 (32)	1.9 ± 1.2	0.6–4.1	8/39 (21)	4.2 ± 4.4	0.6–13.8
Overall		19/64 (30)	3.7 ± 3.8	0.6–14.4	28/91 (31)	5.5 ± 5.7	0.6–22.1

[a] Adapted from Al-Taher et al. *(4)*.
[b] Mean ± SD of concentrations in positive samples (>LOQ or 0.5 ng/g).
[c] —, no positive samples obtained.

year), were analyzed for levels of OTA (Table 2). Results of OTA analyses of the infant cereals obtained in the first survey year were published previously by Al-Taher et al. *(4)*. Overall, 19 (30%) of 64 samples collected from the first year and 28 (31%) of 91 samples collected from the second year were contaminated with OTA, with concentrations ranging from 0.6 to 22.1 ng/g. No significant difference was observed in the mean concentration of OTA among positive samples (>LOQ of the analytical method; 0.5 ng/g) from the first year (3.7 ± 3.8 ng/g) compared with the second year (5.5 ± 5.7 ng/g) ($P < 0.05$). In this study, all of the OTA-contaminated samples from both years of collection exceeded the maximum OTA limit established by the Euroean Union (EU) (0.5 ng/g) for cereal-based infant foods. At present, there are no regulatory limits for OTA in foods in the United States.

A similar incidence (101 of 296, 34%) of OTA contamination was observed in a survey of infant cereals obtained in Canada from 1999 to 2002 *(30, 33)*. The mean concentration of OTA in contaminated samples was 0.23 ng/g, and 9% of analyzed samples were greater than the EU limit and proposed Canadian limit for OTA in infant cereals of 0.5 ng/g. Araguás et al. *(6)* reported that the incidence of OTA in cereal-based baby foods from Spain was 70% (14 of 20 samples), with a mean concentration of 0.187 ng/g and a maximum concentration of 0.740 ng/g. Similar to the Canadian survey, the Spanish study found 10% of the total number of infant cereals exceeded the EU maximum limit for cereal-based baby food (0.5 ng/g). In Italy, infant cereals were analyzed by Beretta et al. *(9)* and Juan et al. *(26)*; both studies reported that <21% of sampled infant cereals were contaminated with OTA and that <5% of all samples had OTA levels greater than the EU limit (0.5 ng/g). Although no products exceeded the EU limit for OTA, 8 (40%) of 20 cereals from Portugal had concentrations ranging from 0.034 to 0.212 ng/g *(5)*. Contamination of OTA in cereal-based baby foods was also reported in products from Turkey. Baydar et al. *(8),* Kabak *(27),* and Ozden et al. *(41)* observed that 56, 17, and 19%, respectively, of cereal-based baby foods from Turkey were contaminated with OTA. Only in the study by Baydar et al. *(8)* were cereals found to be contaminated with greater than 0.5 ng/g OTA. In contrast, no OTA was found in 20 of the infant cereals (14 wheat based and 6 rice based) from Morocco *(50)*.

It should be noted that in our study, the OTA incidence in oat-based infant cereals (30 of 51, 59%) was the highest followed by mixed grain–based infant cereals (12 of 35, 34%), wheat-based infant cereals (2 of 6, 33%), barley-based infant cereals (1 of 9, 11%), and rice-based infant cereals (2 of 54, 4%) (Table 2). In addition, cereals that were oat-based had the highest OTA concentrations (0.6 to 22.1 ng/g). Similarly, a Russian study observed that 9 (23%) of 40 cereal-based baby foods were contaminated with OTA, with levels of 0.2 to 1.2 ng/g, and OTA levels were higher in oat-based cereal foods *(2)*. The results of our study of OTA occurrence and levels in infant cereal also mirrors results found for breakfast cereals obtained in the United States during the same period (2012 to 2014). In these studies, oat-based breakfast cereal had high incidence (142 of 203, 70%) and levels of contamination ranging from 0.12 to 9.30 ng/g, with 16 samples exceeding the EU regulatory limit (3 ng/g) *(32, 39)*. The results of our study differ from a Canadian survey of infant cereals conducted by Lombaert et al. *(33)*. In the Canadian study, OTA occurrence was evenly distributed among oat-, barley-, soy, and multigrain-based cereals, and much lower OTA concentrations were observed in positive samples (0.06 to 0.21 ng/g) than in our survey of U.S. products.

Differences between the results in our survey and those published by other researchers may be due, in part, to the diversity of analytical methods (e.g., enzyme-linked immunosorbent assay, HPLC-fluorescence detection, LC-MS/MS) used to detect and quantify OTA. In addition, there may be differences in mold and mycotoxin contamination of products owing to the different geographical regions from where the cereal grain ingredients were grown, harvested, and stored *(43)*. Variability in environmental conditions in a specific geographic region may explain the year-to-year differences in mycotoxin levels in food crops. Environmental factors such as temperature, humidity, amount of rainfall, and presence of insect pests are known to influence fungal and mycotoxin contamination of foods *(1, 38)*.

Conventional versus organic infant food products. It has been speculated that foods formulated with organically grown agricultural commodities may have higher incidence and mycotoxin levels than foods formulated with conventionally grown crops *(44)*. Organic agricultural practices prohibit the use of chemical fertilizers and synthetic pesticides (e.g., fungicides, insecticides) such as those that are used in conventional agriculture practices to minimize insect contamination and fungal growth *(44, 50)*. To evaluate this hypothesis, we compared incidence and concentrations of OTA in organic and conventional infant cereals analyzed in this survey. The results obtained from the first year of sampling showed similar incidences of OTA contamination in conventional (9 of 33, 27%) and organic (10 of 31, 32%) cereals. The mean concentration of OTA in conventional samples (5.8 ± 4.7 ng/g) seemed higher than that of organic samples (1.9 ± 1.2 ng/g), but the levels were not significantly different ($P < 0.05$). The results of the second year indicated a higher percentage of OTA-contaminated conventional cereals (38%) than organic products (21%). However, there was no significant difference between mean OTA concentrations in contaminated conventional samples (6.0 ± 6.2 ng/g) than organic samples (4.2 ± 4.4 ng/g) ($P < 0.05$).

Relatively few studies have evaluated the differences in mycotoxin levels in conventional and organic infant foods. Comparisons between conventional and organic baby foods from Italy were reported by Beretta et al. *(9)* and Biffi et al. *(10)*. These studies demonstrated that OTA was more frequently detected, and the concentrations higher, in conventional, semolina-based and multicereal-based baby food samples than in comparable organic baby food samples. In contrast, these studies found that organic rice–based baby foods had a greater frequency of contamination and higher OTA concentrations than conventional rice–

based products. Although OTA was not one of the mycotoxins evaluated, Jestoi et al. *(23)* found no significant effects of agricultural practices on mycotoxin concentrations in grain-based products in Finland and Italy. Similarly, other studies have not been able to clearly demonstrate an effect of agricultural practices on mycotoxin levels in cereal-based foods. According to Nguyen and Ryu *(40)* and Lee and Ryu *(32)*, cereal-based breakfast cereals collected in the United States from the first year of a 2-year survey showed that roughly one-half of the organic and conventional products were contaminated with OTA, whereas the results obtained the second year showed less occurrence of OTA in cereals than those surveyed the first year. The results obtained from the first year showed that 29 (54%) of 54 organic breakfast cereal samples and 32 (44%) of 72 conventional breakfast cereal samples were contaminated with OTA. The mean OTA concentration in contaminated conventional products (0.75 ± 0.65 ng/g) seemed to be lower than the amount in organic foods (1.21 ± 1.70 ng/g). The result of the second year showed the opposite trend, with 60 (38%) of 158 organic breakfast cereal samples and 84 (41%) of 205 conventional breakfast cereal samples contaminated with OTA compared with the result of the first year. The mean concentration of OTA among positive organic breakfast cereal samples (0.64 ng/g) was higher than that of conventional breakfast cereal samples (0.57 ng/g). However, it is not clear whether the concentrations were significantly different. A survey of cereals purchased in Spain and Portugal found that organic cereals (wheat, maize, oat, barley, rye, rice, and spelt) were more frequently contaminated with OTA than conventionally grown cereals (72 versus 28%) and that the average OTA concentrations were also higher (1.64 versus 0.05 ng/g) *(26)*.

Other research studies have failed to determine a corrrelation between mycotoxin occurrence and levels in cereal grains and agricultural practices by which they were grown. For example, Birzele et al. *(11)* and de Galarreta et al. *(15)* found no difference in mycotoxin contamination of conventional samples of winter wheat (deoxynivalenol and OTA) and maize (fumonisins and deoxynivalenol) compared with organic samples. In an evaluation of mycotoxin content of organic and conventional oat grown in southeastern Poland, a higher percentage of organic oat (83%) was contaminated with OTA compared with conventional oat (63%); however, the concentrations of OTA present were not different. The lack of a clear difference in the incidence and concentration of mycotoxins in organic and conventionally grown agricultural commodities suggests that fungal and mycotoxin contamination of foods is affected by many factors, such as environmental and geographic location where crops are grown. In addition, harvest and storage conditions may influence mycotoxin production.

The results of this study indicate that milk- and soy-based infant formula products obtained in U.S. markets during the 2-year survey period (2012, first year; 2013 to 2014, second year) did not contain detectable amounts of OTA. These results suggest that infant formula products available in the United States do not contribute appreciable amounts of OTA to infants in the United States. However, because samples were only collected over 2 years, there is always the possibility of differences in frequency and levels of contamination, depending on year-to-year contamination of the ingredients (milk and soy) used to manufacture infant formula products. Our study found that infant cereals, particularly those formulated with oat and mixed grains, were frequently contaminated with OTA. This survey examined fewer wheat- and barley-based infant cereals than oat- and mixed grain–based products, as these cereal products are not as widely available in the U.S. market. However, the analyses of the few samples that were obtained suggest that the barley- and wheat-based cereals had a lower incidence of contamination with OTA than the other cereals. It is important to note that the concentrations of OTA in positive cereal samples were above the EU (and proposed Canadian) limit (0.5 ng/g) for OTA in infant and baby foods. However, currently, there are no regulatory limits for OTA in the United States. Considering that cereals are the major source of exposure of infants to OTA, it is prudent to ensure that the toxin is present in infant cereals at concentrations as low as reasonably achievable. The results of this study suggest that surveillance programs should be established to monitor OTA levels in grain and other ingredients used in infant foods at high risk for OTA contamination. In addition, research is needed on intervention strategies for preventing and reducing contamination of food with OTA and other mycotoxins.

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