Contamination of food with newspaper ink: An evidence-informed decision making (EIDM) case study of homemade dessert

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Abstract: In this evidence-informed decision making case study report, the authors discuss three public health concerns: (1) home food preparation businesses, (2) right of entry into a private residence, and (3) food contamination by newspaper ink including chronic health effects related to other trace toxins exposure. Home food preparation businesses have proliferated throughout Ontario following the prevalence of Internet access. Private residences are increasingly used for the preparation of food for public consumption, offering a full array of products, and extending in scope to encompass a broad range of commercial catering businesses. The major concerns for Public Health are a lack of food safety knowledge and inadequate facilities to protect food from contamination and adulteration at these home-based businesses. Legal restrictions limit Public Health Inspectors' access to a private residence, regardless of the known or anticipated health concerns. In this particular case, food was prepared in the garage of a single-family home and then delivered by truck to commercial units in a strip plaza for further processing. In this case, chemical contamination of food from the use of recycled newspaper to drain excess cooking oil from fried donuts raised serious health concerns. Researchers report that newspaper ink contains ingredients such as Naphthylamine, aromatic hydrocarbons, and other aryl hydrocarbon receptor agonists that have multiple negative health effects.

Key words: evidence-informed decision making, home-prepared food, rights of entry, newspaper ink, aryl hydrocarbon receptor, contamination.

Introduction

As a result of a complaint in the summer of 2008, the Regional Municipality of Peel (RMP) Health Department's Public Health Inspectors (PHIs) investigated alleged commercial food preparation of desserts in the garage of a single-family home. During the investigation, the RMP PHIs discovered that the operator was using a number of commercial strip plaza units to store, as well as further process, and package the food items that had been manufactured in the residential garage.

Event summary

Home food preparation business investigation suggests contamination and adulteration

The RMP PHIs, accompanied by municipal Fire Department and Property Standards Officers, conducted an inspection of the alleged commercial food preparation in the garage of the family home. The inspection revealed an extensive commercial

food (dessert) preparation and packaging operation that had commenced without the approval of the Medical Officer of Health pursuant to Section 16(1) of the Health Protection and Promotion Act, R.S.O. 1990, CHAPTER H.7 (HPPA).

The RMP PHIs found a number of areas of noncompliance with the Health Protection and Promotion Act (HPPA), Ontario Regulation 562, (Food Premises) (R.R.O. 1990, Reg. 562). There was no potable hot and cold running water under pressure for use, although the inspection noted that the food preparation area was equipped with a three-compartment sink. As well, there was no hand-washing basin, and chemicals and equipment not related to food preparation were being stored adjacent to the food preparation area (Figures 1 and 2).

Inspection of the commercial storage units, including the delivery trucks

Immediately after inspecting the residential garage food preparation business, the RMP PHIs inspected the corresponding commercial strip plaza units.

First, the RMP PHIs inspected two commercial refrigerated trucks that were being used to transport food from the

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Figure 1. A drill used as a dough mixer in the unsanitary food preparation area in the garage of the family home.

Figure 2. Another view of the unsanitary condition of the food preparation area in the garage of the family home.

residential location to two of the plaza units, raising some concerns. The temperature in the refrigerated trucks was 19°C. Food storage was inappropriate as deep-fried desserts were stored in yard waste paper bags and in non-food-grade bulk blue plastic barrels without lids. Empty waste bottles were found under the desserts at the bottom of these barrels, and wads of newspaper were on the top of the desserts (Figure 3). Raw dough was stored in black plastic garbage bags. Raw dough and deep-fried desserts along with a considerable quantity of recycled newspaper and waste were mixed indiscriminately on the truck floor beds.

In the two plaza units, RMP PHIs found that a significant amount of desserts were draining at room temperature on top of recycled newspapers. Plastic packages with commercial labels, some filled with desserts, were found sitting directly on the cement floor (Figures 4 and 5).

Results

Field investigation

After careful consideration of the potential health hazards associated with the method of the food preparation, the operator was ordered to immediately stop the home-based food business in this previously non-approved residential garage. The RMP Health department recommended that the operator relocate the food business to an approved existing food premises or open a food business in which RMP PHIs

Figure 3. Wads of newspaper were on the top of the desserts stored in an opened non-food grade container and surrounded by garbage.

could conduct routine inspections. Considering the unsanitary food preparation conditions and the potential health hazards of newspaper ink contamination, the dessert was deemed unfit for human consumption.

Figure 4. Plastic packages with commercial labels, some filled with desserts, sitting directly on the cement floor.

Figure 6. Supervised disposal of products.

Figure 5. Plastic packages with commercial labels, some filled with desserts, sitting directly on the cement floor.

Figure 7. Supervised disposal of products.

Food disposal

Several tons of the dessert was condemned and RMP PHIs supervised the disposal of the product (Figures 6–8). A fork lift and several bulk garbage dumpsters were used to dispose of the contaminated product.

Discussion

Home-prepared food business

Uninspected commercial food businesses operating out of private residences in Ontario are a major concern to local public health authorities. They are prolific, and can easily be accessed through a variety of Web sites.

Home-prepared food businesses have been linked to numerous food-borne illness outbreaks (Conter et al. 2009; Porter et al. 1990; Weir 2005). These businesses are usually not

inspected by PHIs; generally, home-based food businesses do not meet the minimum requirements of Ontario Regulation 562 (Food Premises) under the HPPA. Although literature reveals that food-borne illnesses are increasing, and most food-borne illnesses go unreported, it is difficult to determine the number of sporadic outbreaks resulting from home food preparation (Redmond and Griffith 2003; Scott 2003).

Home-prepared foods have been implicated as a major cause of food-borne illness outbreaks in many countries, including Canada and the US (Hayrettin et al. 2007; Porter et al. 1990; Rivas et al. 2003; Weir 2005). Regardless of location, researchers have identified similar health hazards related to different kinds of home food preparation processes irrespective of cultural background (Bryan 1995; Conter et al. 2009).

Risk factors for home-prepared foods include: poor hygiene practices, unsanitary conditions, improper food storage, and a lack of food safety knowledge. Studies indicate that 71% of home-based food handlers have never had any food safety training (Scott 2003). A UK study of home-based catering

Figure 8. Supervised disposal of products.

operations found that foods were stored inappropriately in the home kitchens at least 50% of the time (Evans et al. 1998; Scott 2003). Other factors may also contribute to food contamination in the home environment, such as home childcare practices, the presence of pets, rodent and insect infestations, and improper chemical storage.

Consequently, PHIs should discourage home-based food businesses due to the increased potential for health hazards. Instead, food businesses should be located in commercial facilities that PHIs can routinely inspect and where food safety regulations can be applied.

Right of entry

Aside from the public health risks mentioned, PHIs are also faced with the dilemma associated with right of entry for inspection purposes. Even though the HPPA excludes a private residence as a food premises, it does not interpret the meaning of a private residence. However, Webster's New Collegiate Dictionary defines a private residence as a place where one actually lives. Accordingly, if a food preparation area is not separated from a living space, the entire home, including the food preparation area, is excluded from regular inspection, since the place where a person lives is not subject to Ontario Regulation 562 (Food Premises).

This lack of jurisdiction often presents a challenge for public health professionals. Entry becomes problematic should the residential premises owner disallow or deny entry to the PHI for inspection or investigative purposes. Should PHIs need to enter a private residence without consent of the occupier, the legal remedy is to obtain a Justice of the Peace warrant under the HPPA. Part V of this Act clearly outlines the rights of entry and powers of inspection that give the PHI the authority to inspect, investigate, and conduct enforcement activities associated with the HPPA and regulations within the health unit's jurisdiction.

Part V, Section 41(3) of the HPPA provides PHIs with the power and right to *enter and have access to, through and over any premises* for the purpose of enforcement of the Act and regulations. Section 41(4) and (5) also provide PHIs with

both the power and right to test, examine, and sample during inspections and investigations when conducted at reasonable times. Even so, the HPPA does not provide the authority to enter a private residence without the consent of the occupier.

Nevertheless, refusal of consent to a PHI to enter a private residence is not considered obstruction. To manage this situation, PHIs can request formal access to, through, and over any premises including a private residence by holding a Justice of the Peace warrant. If a PHI possessing a warrant is obstructed from entering a private residence, the PHI can then enter, by force if necessary, together with police or other designated officers [HPPA clause 43(1) (b)]; police and fire officers always have the right to enter a private residence in life and death situations.

In our case investigation, since the food preparation area was located in the garage of a private residence, PHIs required the consent of the occupier to gain entry. The occupier (not the owner) provided consent for the PHIs to conduct an inspection of the garage; therefore, a warrant from a Justice of the Peace pursuant to section 43 of the HPPA was not required.

Health effects of newspaper ink and recycled packing materials

While inspecting the trucks used to transport the desserts, the operator informed the RMP PHIs that the large amount of recycled newspaper being transported with the dessert was for draining oil from the desserts that were located within the two plaza units. Correspondingly, while inspecting the plaza units, RMP PHIs did find a large amount of dessert draining on top of recycled newspapers in the plaza units. When asked, the operator stated that this oil draining process usually takes over 24 hours.

Foods contaminated by newspaper ink raise specific health concerns since the ink contains multiple bioactive materials with known negative health effects. Naphthylamine and aromatic hydrocarbons are the major concerns (Leach et al. 1993; Zhou and Stanley 2011). Direct evidence indicates an increased risk of lung cancer among newspaper printing workers who have been exposed to ink mist containing these chemicals (Leon et al. 1994). Bladder cancer is another notable disease associated with ink and dye. Most diseases, including cancers, have multiple factors for etiology; however, exposure to Naphthylamine, Benzidine, and 4-Aminobiphenyl has long been established as the major risk factor for bladder cancer with this risk being proportional to the length of exposure (Henry et al. 1988; Konety and Carroll 2008; Ruder et al. 2005).

Research has also shown health concerns regarding exposure to some other specific ink chemicals. For example, 2-Naphthylamine induced rat bladder cancer (Hicks et al. 1982). As well, arylamines exposure (cigarette smokers, hair-dressers, and workers of dye and textile industries) has been linked to a significantly higher risk for bladder cancer in men (Al-Zoughool et al. 2006).

In addition to the above-mentioned carcinogenic effects of the printing ink, other research shows that newspapers and newspaper ink contain agonists for the AhR (Bohonowych et al. 2008). The AhR pathway is a ligand-dependent, basic

Figure 9. Deep-fried dessert draining on the top of recycled newspaper (Red enclosed area indicating the oil soaked newspapers).

helix-loop-helix, Per-Arnt-Sim-containing transcription factor that mediates a diverse array of biological and toxicological effects in a variety of species (Woods et al. 2008).

Some evidence indicates that chronic exposure to relatively high doses of a metabolically labile polycyclic aromatic hydrocarbon (PAH) AhR agonist, i.e. β -Naphthoflavone can be as effective at producing AhR-dependent toxicity as a single exposure to those that are metabolically persistent (Bohonowych et al. 2008; Grady et al. 1992; Navas et al. 2004). Other research indicates that when a PAH metabolizing enzyme, such as CYP1A (cytochrome P450, family 1, subfamily A) is either chemically inhibited or knocked down, metabolically labile AhR ligands will produce AhR-dependent toxic effects (Billiard et al. 2006; Wassenberg and Di Giulio 2004).

The above-mentioned research implies potential negative health effects for vulnerable populations with compromised organ functions, such as those with a compromised immune system, as well as seniors and the very young.

Since the complex mixture of chemicals from newspaper ink can contain both CYP1A inhibitors and AhR agonists, the exposure to such an extract on a chronic basis could lead to AhR-dependent toxicity.

During the commercial storage units' inspection, toxicity concerns emerged. Certainly, the direct contact between the greasy food and the newspaper increases the risk of newspaper ink and chemicals being absorbed by the food through the cooking oil (lipid), which acts as a good medium for the transfer of ink ingredients. To better understand this transfer process, we want to introduce some interesting facts: firstly, most newspapers are printed with soy-based inks; secondly, vegetable oils (cooking oils) are the oldest and still most widely used raw material in the ink industry (Leach et al. 1993). Furthermore, both the direct contact and relatively long contact time (more than 24 hours) increase the level of the food been contaminated by the ink (Figure 9).

Figure 10. Red arrow indicates a layer of food-grade virgin paper between the food and printed packing.

Lessons learned

PHIs should remain vigilant about home prepared foods during inspections, especially for special events, flea markets, and seasonal vendors. PHIs should also be aware and ready to deal with right of entry issues once the situation arises. PHIs should be more attentive to chemical contamination during routine inspections. Food that comes in direct contact with printed wrapping should not be overlooked since ink and dye have a much more complicated effect on health than their carcinogenic properties alone.

PHIs should recommend that food premises operators (i.e. fish and chips and other food premises) place a layer of virgin paper or any clean food grade material between the food and the printed or recycled packing materials to prevent the food from coming in direct contact with the unsafe ink (Figure 10).

Future challenges

Regulating the home-based food industry, which has been particularly aided by the Internet, has become a grey area from a food safety point of view (Gordon 2011). The current Ontario Regulation 562 (Food Premises) may require updating to appropriately reflect changes in the current food industry especially with growing public access to the Internet. Until stricter regulations come into force and/or PHIs gain greater authority, home prepared food will remain a potential threat to public health and food safety.

In particular, the dangerous practice of wrapping, covering or processing foods with newspaper and printed recycled paper materials remains commonplace worldwide, as seen in the plethora of photographs in advertisements online or in magazines showing newspaper wrapped foods. Importantly, the resultant negative health effects are not necessarily immediately recognized so the appropriate level of concern may not be realized. For instance, the latency for chemically induced bladder cancer can be anything from 5–45 years (Ruder et al. 2005). Bladder cancer is just one example among many

other diseases related to ink and dye exposure. Similar long intervals from first exposure to the onset of symptoms also occur in other carcinogen induced cancers (Ruder et al. 2005).

The health hazard of ink contamination to foods and long-term contact with complex chemicals should always be considered because of the potentially diverse array of biological and toxicological effects. Further research is warranted to support stricter regulations to eliminate public exposure to these potent hidden health hazards. Currently, tracking the results of chronic environmental exposure to a trace mixture of toxins during daily life is extremely difficult.

In this particular case, RMP PHIs conducted an evidence-informed decision making (EIDM) process, avoiding costly and time consuming "direct link" lab research by using all of the related research data indicating multiple health effects from chronic exposure to printing ink. In addition to routine microbiological testing, food samples could also be analyzed for the presence of the above-mentioned carcinogens, AhR agonists and any substrates of enzyme metabolic systems, for example, Cytochrome P450, which could be affected. The lab results could be correlated with the newspaper ink ingredients to establish the relationship of ink contamination and related health effects.

We hope this article triggers a greater interest in chronic trace toxin exposure for food safety and other environmental concerns. Usually, these toxic effects tend to be ignored because such exposure may not cause immediate noticeable reactions such as vomiting and diarrhea. Yet, they are considerably more deleterious to our health when long-term exposure occurs.

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