Project: Flatware rests to reduce risk of microbial cross-contamination from table to flatware

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Introduction: Restaurants serve >70 billion meals in the United States each year (Angulo et al. 2006). In 2014, food-away-from-home sales surpassed food-at-home sales with over 50% of total food expenditures (Saskena et al. 2018). Overall, it is estimated that at least 40% of the U.S. population eats in a restaurant on any given day. Unfortunately, foodborne disease causes ~48 million illnesses each year in the U.S. with over 800 foodborne disease outbreaks (FBDO) reported annually to the U.S. Centers for Disease Control and Prevention (Scallan et al. 2011a, 2011b). From 1998 to 2013, 56% of the 17,445 outbreaks reported were restaurant-associated with the most common contributing factors being those related to food handling and preparation (61%) and food worker health and hygiene (47%) (Angelo et al. 2017). Within these broad categories, cross-contamination contributed to 32% of issues linked to food handling and preparation. With respect to cross-contamination from environmental surfaces, proper cleaning and sanitation are the primary tools available. However, previous research has shown that the cleaning tool itself can become the source of contamination. For example, Gibson et al. (2012) demonstrated that generic cotton terry towels—commonly used in food service establishments—can readily contaminate a surface if used previously to remove pathogens from a different surface. In addition, the sanitizing compounds most commonly used in food service establishments (e.g., quaternary ammonium compounds) are ineffective against human noroviruses (hNoV)—the primary cause of foodborne disease in the U.S. (Feliciano et al. 2012; Kingsley et al. 2014; Scallan et al. 2011a).

Objective: To demonstrate how the Dining Elevated UPLIFT™ flatware rests can provide a physical barrier between a contaminated tabletop surface and eating utensils.

Methods: *Escherichia coli* C3000 (ATCC 15597, American Type Culture Collection, Manassas, VA), *Salmonella Typhimurium* LT2 (ATCC 19585), and MS2 bacteriophage (ATCC 15597-B1)—a surrogate for hNoV—were used in the present study. Preparation of bacteria inoculum was done in accordance with AOAC International Official Method 920.09 while preparation of MS2 bacteriophage was done as previously described (AOAC International 2011; Gibson et al. 2012). The tabletop surface was composed of a non-porous melamine material (Room Essentials™, Target Corporation, Minneapolis, MN).
For each experiment, two 5 by 1.5-inch areas were inoculated with ~6 log colony forming units (CFU) of each bacterial type or plaque forming units (PFU) of MS2 and allowed to dry on the surface for 30 min (Figure 1). Two pieces of stainless-steel flatware (spoon and fork) were placed on the contaminated areas with either 1) the head of the flatware resting directly in the contaminated area on the tabletop surface or 2) the “neck” of the flatware placed on the marble or stainless steel flatware rest (Dining Elevated UPLIFT™, Los Angeles, CA) located on top of the contaminated area (Figures 2 and 3). The utensils were left for 5 minutes followed by swabbing with calcium alginate-tipped swabs presoaked in 2.25 mL of buffered phosphate water (Figure 4). The bottom of flatware rests in contact with the contaminated surfaces were also swabbed (Figure 5). Swab samples were vortexed for 10 s, serially diluted in 0.1% peptone, and plated on 3M Petrifilm™ E. coli/Coliform Count Plates and XLT4 plates for E. coli and Salmonella detection, respectively, or tryptic soy agar using the double agar layer assay for MS2 detection as described previously (Almeida and Gibson 2016; Conover and Gibson, 2016; Dusch and Altwegg, 1995). All plates were incubated for 18 to 24 h at 37°C. Following incubation, CFU or PFU were counted and recorded per milliliter. These data (CFU or PFU/mL + 1) were then log_{10} transformed for analysis. All experiments were completed in duplicate with biological replicates as well positive and negative control samples for a total of 98 samples per microorganism (n = 294).

Results: To determine recovery efficiency of the microorganisms from the surface, swabs were collected from the inoculated areas on the tabletop. After 5 min, 4.56, 5.54, and 5.30 log_{10} (CFU or PFU/mL + 1) were recovered from the tabletop surface for E. coli, Salmonella, and MS2, respectively. The transfer of microorganisms from the contaminated tabletop surface or flatware rests after a 5 min contact time is shown in Figure 6. On average, 3.82, 4.67, and 3.53 log_{10} (CFU or PFU/mL + 1) were recovered from the flatware in direct contact with the contaminated surface for E. coli, Salmonella, and MS2, respectively. No microorganisms were recovered from the flatware placed on either the marble or stainless steel flatware rests. Flatware rests contacting the contaminated surfaces were also swabbed with 4.50, 5.50, and 4.99 log_{10} (CFU or PFU/mL + 1) E. coli, Salmonella, and MS2, respectively, recovered from the bottom of the marble flatware rest, and 3.75, 4.85, and 3.17 log_{10} (CFU or PFU/mL + 1) E. coli, Salmonella, and MS2, respectively, recovered from the bottom of the stainless steel flatware rest.

Conclusions: Flatware rests are a simple solution to prevent cross-contamination of foodborne pathogens from the tabletop to utensil, and thus, an added layer of consumer protection. Food service establishments—and the hospitality industry in general—should consider physical barriers to microbial contamination as an additional step in preventive controls for foodborne pathogens.
References Cited:


Figures

**Figure 1.** Inoculation of prepared surface with a cocktail of bacteria or MS2 phage.

**Figure 2.** Flatware placed directly on the contaminated areas of the tray (areas 1 and 2) or area 3 which served as the non-inoculated negative control.
Figure 3. Flatware placed directly on the flatware rests located on top of the contaminated areas of the tray (areas 1 and 2) or area 3 which served as the non-inoculated negative control.

Figure 4. Swabbing the flatware after 5 minute contact time with contaminated surface or flatware rests.
**Figure 5.** Swabbing the flatware rests after 5 minute contact time with contaminated surface.

**Figure 6.** Recovery of microorganisms from utensils (spoon + fork) after 5 min contact time with contaminated surface or flatware rest. Each error bar is constructed using 1 standard deviation from the mean. SS = stainless steel

ZERO transmission of bacteria to silverware using both rest types