

Benefits of Paper Placemat or Tray Cover Use in the Reduction of Bacterial Contamination in Selected Public Facilities

Introduction

A study documenting the sanitary benefits of paper placemats was conducted by the Food Protection Laboratory of the Syracuse Research Corporation. Samples were collected from tabletops and placemats on the same tables in several restaurants using specialized bacterial collection plates. The plates were incubated and the number of bacterial colonies on each plate was calculated. Results from this study demonstrated that placemats help in the reduction bacterial transfer from tabletops. Numbers of bacteria on tabletops were 214 times greater than numbers of bacteria on the placemats and the number of pathogenic bacterial colonies was approximately 100 times greater on bare tabletops.

A more recent study, conducted in 1997 by UW Oshkosh Environmental Studies staff member Allison Collins-Rainboth and three UW Oshkosh Microbiology students, found similar results to the study conducted by the Food Protection Laboratory of the Syracuse Research Corporation. Samples were collected from placemats and tabletops in the cities of Berlin and Oshkosh. The objective of this study was to expand upon the study conducted in 1997 to include new groups of facilities (Table 1) and a more detailed breakdown of the microorganisms present. In the restaurants and daycares the objective was to evaluate microbial loads on placemats versus uncovered tables. In long-term care facilities, lodging, and hospitals tray covers were compared to uncovered trays.

Table 1. Categories and Comparisons for Study

Category	Comparison
Restaurants	Placemat vs. Uncovered Table
Long-Term Care	Tray Covers vs. Uncovered Trays
Daycares	Placemat vs. Uncovered Table
Lodging	Tray Covers vs. Uncovered Trays
Hospitals	Tray Covers vs. Uncovered Trays

This report presents the results of a study conducted by UW Oshkosh Microbiology professor Greg Kleinheinz, R.S., Ph.D. and UW Oshkosh Microbiology graduate students, Rebecca Giebel and Amanda Griesbach. This study reexamines the benefits of using disposable paper placemats or tray covers to reduce the amount of bacteria contacted while eating at certain types of facilities.

Methodology

Before the initiation of sampling, UW Oshkosh Microbiology graduate students contacted selected facility owners by telephone. The purpose and sample collection process of the study were explained to the owners or managers. A date and time for sampling to be conducted was arranged with owners or managers agreeing to participate in the study. A consent form (Appendix A) was signed and dated by each facility manager/owner. Each facility was instructed not to change any cleaning procedures prior to sampling. Participating businesses each received a free case of paper placemats for participating in the study. The facilities were chosen randomly in areas including: Oshkosh; Escanaba, MI; Steven Point; Sturgeon Bay; Fond du Lac; Ripon; Winneconne; Waupaca; Berlin; Appleton and Green Bay. Chain restaurants were avoided due to specific rules with placemat/tray cover types. As stated previously, in restaurants and daycares the objective was to evaluate microbial loads on placemats versus uncovered tables. In long-term care facilities, lodging, and hospitals tray covers were compared to uncovered trays.

The sampling protocol was followed from Standard Methods for the Examination of Dairy Products, 16th edition (1985). This sampling method is commonly used by microbiologists and public health officials to quickly and accurately estimate bacterial colony numbers. Rodac[®] plates were utilized in the sampling process, making sampling easy and efficient, by stamping the exposed media on the surface being tested. This medium can be used on non-porous surfaces for the detection of a wide range of microorganisms.

Samples were usually collected mid-afternoon, following the lunch hour. This time period did not interrupt business owners around the lunch hour, but also possibly allowed for collection of live bacteria. The samples were collected by the two graduate students, which recorded the date, time, and location of the sample. The samples were collected by uncovering the Rodac[®] plate, inverting it, and stamping the agar on the sample surface. A total of twenty plates were used per facility, ten tabletop/tray surfaces and ten placemat/tray cover surfaces. If a location did not use placemats/tray covers just the tabletop/tray was sampled. After the samples were collected they were transported to UW Oshkosh where they were incubated for 24 hours at 31°C.

Following the incubation period, plates were counted and identified by morphology. Aseptic technique was used when handling plates, since bacterial colonies may have been pathogenic. Each identified colony was then gram-stained and examined under a microscope to determine its gram reaction and morphology. Accordingly, screening methods, using selective media, could be used to further identify the bacterial species. This sampling procedure included using a loop and streak method. A sterile loop containing bacteria was streaked across a plate containing the appropriate selective media. The media was then incubated at 35-37°C for 24 hours. Depending on the biochemical reactions found the isolates were placed in the appropriate grouping.

Testing methods used in this study included: microscopic morphologically, gram-stain, catalase, oxidase, spore formation, fermentation of mannitol using MS (Mannitol Salt) plates, lactose fermentation on EMB (Eosin Methylene Blue) plates, and examination of colony morphology and color. These methods were used for all bacteria recovered.

Sampling was conducted from mid-January to mid-May, at times convenient to samplers and facilities. After identification of bacteria, plates were autoclaved and disposed of using the University's standard protocol for biological waste disposal.

Results

A total of 50 facilities, in the five aforementioned groups, agreed to have their locations participate in this study. All sample analysis was conducted by the microbiology graduate students. The overall totals and coliform means are summarized in Table 2.

Table 2. Average total and coliform counts for table top/tray (TT) and placemats/tray covers (PM).

Category	Tabletop/Tray	Placemat	TT Coliforms	PM Coliforms
Restaurants	362.4	50.8	28.7	1.2
Daycares	1578.4	0a	302	0a
Long-Term Care	126.2	5.8	8.9	0
Lodging	256.8	12.1	34.7	0
Hospitals	150.1	9.8	2.6	0

No facilities used placemats

Most groups of facilities were more than willing to let us into their facility to test surfaces and the participation rate was ~75%. The lone exception was the hospital group. It took over 200 phone calls to set-up the 10 site visits, and hospitals in two states were used. This group was very reluctant to allow testing in their facilities and several facilities were sampled over a wide geographic range. Additionally, the bureaucratic nature of these facilities required multiply levels of approval at times and made this group as time consuming as all other groups combined.

The daycare group did not have any placemat data due to the fact that none of the facilities we contacted used placemats. All other groups (Long-term care, restaurants, hospitals, and lodging) showed a statistically significant difference between the samples that had placemats/tray covers when compared to samples that did not use this protective barrier (Table 3). While the daycare facilities had no statistics conducted due to the lack of placemat, these facilities had the highest levels over overall microbes and ten-times the amount of coliforms of the next highest facility group. Interestingly, no daycares we contacted used placemats. It would not be surprising if placemats would benefit these facilities as much, or likely more, than any other group in this study. Given the very high levels of microbes and coliforms (Tables 1 & 2) found in daycares, and the likelihood of disease transmission between children, it appears that these facilities could make effective use of placemats.

Restaurants and lodging facilities were the next two groups with the highest levels of overall microbes and coliforms. The hospital and long-term care facilities demonstrated the least amount of overall microbes and coliforms. This may not be surprising due to the great lengths these facilities take to maintain a sanitary environment.

**Table 3. Paired t-test results showing statistical analysis results.
(alpha=0.05)**

Category	Significant Difference	p-value
Restaurants	Y	0.037
Daycares	Y	0.043
Long-Term Care	n/aa	n/aa
Lodging	Y	0.008
Hospitals	Y	0.029

aaNo facilities used placemats

While the placemats/tray covers were very successful as a barrier to overall bacterial contact, they were particularly effective as a barrier to coliforms (Figures 1 and 2). Additionally, there were much higher levels of Staphylococcus found in samples with no placemats/tray covers. Only one group (restaurants) showed any coliforms when the placemats were sampled (Table 2 and Figure 2). Again, the daycares had the largest level of microbes present and the long-term care facilities had the lowest (Figure 1). As mentioned previously, the daycares had the highest level of coliforms and the hospitals had the lowest (Figure 2).

Discussion

This study shows similar results to the two previous studies mentioned in the Introduction. The placemats/tray covers provided an excellent barrier to the inadvertent contact with microorganisms at a number of facilities. Statistical analysis of the overall microbial means within each group showed a significant difference in all groups that had both covered and uncovered sites. Additionally, the daycare group did not use placemats, but likely could benefit from their use due to their relatively high level of microbes and coliforms. This overall lack of microbial contact would likely translate into a more sanitary environment, and consequently an environment that would be less likely to transmit disease causing microorganisms to unsuspecting users of these facilities. This principal is no more important than in a daycare where children lack the basic understanding of sanitation and personal hygiene.

Given the relatively low cost of these paper products they could be a value-added public health benefit to all these facilities. A cost-benefit analysis may be warranted to show operators of these facility types that the benefits of using placemats/tray covers far outweigh any addition costs to the facility. If more facilities used these barriers it would be an asset to environmental public health and may be able to prevent the spread of common illnesses.