

**Citation:**

DeVere E, Purchase D. Effectiveness of domestic antibacterial products in decontaminating food contact surfaces. *Food Microbiol.* 2007 Jun; 24 (4): 425-430. Epub 2006 Sep 27.

**PubMed ID:** [17189769](#)

**Study Design:**

Non-randomized Trial

**Class:**

C - [Click here](#) for explanation of classification scheme.

**Research Design and Implementation Rating:**

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

**Research Purpose:**

- To investigate the effectiveness of domestic antibacterial wipes and sprays in preventing cross-contamination in a household using a single cutting board initially for the preparation of raw meat followed some time later by the preparation of high-risk ready to eat food
- The condition under investigation is the products' effectiveness when used up to two hours after the preparation of contaminated food but immediately before the preparation of ready to eat food.

**Inclusion Criteria:**

Test surfaces chosen:

- Wood
- White polyethylene plastic
- Microban<sup>®</sup> incorporated plastic (MIP)
- Glass tiles.

The antibacterial products used were:

- Flash Wipes, Proctor and Gamble, UK
- Sainsbury's Antibacterial All Purpose Wipes, Sainsbury, UK
- Dettol Antibacterial Surface Cleanser Spray, Dettol, UK
- Sainsbury Perform and Protect Antibacterial Cleaner Spray, Sainsbury, UK.

**Exclusion Criteria:**

None specifically mentioned

**Description of Study Protocol:**

## **Recruitment**

Rationale for selecting test surfaces and antibacterial products not described.

## **Design**

Non-randomized Trial

## **Blinding used**

Not applicable

## **Intervention**

Four commercially available antibacterial products (two wipes and two sprays) were tested under laboratory conditions on a range of food contact surfaces.

The antibacterial products used were:

- Flash Wipes, Proctor and Gamble, UK
- Sainsbury's Antibacterial All Purpose Wipes, Sainsbury, UK
- Dettol Antibacterial Surface Cleanser Spray, Dettol, UK
- Sainsbury Perform and Protect Antibacterial Cleaner Spray, Sainsbury, UK.

The active ingredients in wipes were butoxypropanol and ethanol or Microban® (a broad-spectrum antimicrobial containing triclosan). The sprays contained isopropanol and surfactants or Microban® as antimicrobial agents.

The food contact surfaces tested:

- Wood
- Glass
- Plastic
- Microban® incorporated plastic (MIP).

*Escherichia coli* (ATCC 23848) and *Staphylococcus aureus* (ATCC 9144) were used to investigate the effectiveness of the antibacterial products on both Gram-positive and Gram-negative bacteria.

- The surfaces were inoculated with 10 x 10µl of cell culture (three drops per line, three lines per plate plus a single drop at the bottom)
- The inoculated surfaces were dried at room temperature for periods of 30, 60 and 120 minutes before being treated with the antibacterial products
- Dry sterile wipes (sterile lint dressing) were used where wiping was required and manufacturers' instructions were followed for the application of products
- Wipes and the sterile cloth were rubbed across the surface from left to right and back to left working down the surface until the whole area had been wiped
- Where the test surface was grooved, the surface was sampled in the direction of the grooves
- The control received no antibacterial products
- Immediately after treatment with the product, the surface was placed into a large Petri dish and overlaid with nutrient agar containing neutralizer
- All plates were incubated for 24 hours at 37°C and all the experiments were carried out in duplicate.

## Statistical Analysis

- Non-parametric tests were used to analyze the data
- Kruskal-Wallis test analyzed the equality of the median values for two or more populations and the hypothesis for this test assumed that all medians are equal
- P-value of <0.05 was considered statistically significant.

## Data Collection Summary:

### Timing of Measurements

- The inoculated surfaces were dried at room temperature for periods of 30, 60 and 120 minutes before being treated with the antibacterial products
- All plates were incubated for 24 hours at 37°C and all the experiments were carried out in duplicate.

### Dependent Variables

- Survival of *E. coli* and *S. aureus*
  - Viable bacteria were enumerated using the in situ nitroblue tetrazolium (NBT) method according to Barnes et al (1996) where colonies present were characterized by a deep purple color.

### Independent Variables

Test surfaces:

- Wood
- Glass
- White polyethylene plastic
- Microban<sup>®</sup> incorporated plastic (MIP).

Antibacterial product:

- Flash Wipes, Proctor and Gamble, UK
- Sainsbury's Antibacterial All Purpose Wipes, Sainsbury, UK
- Dettol Antibacterial Surface Cleanser Spray, Dettol, UK
- Sainsbury Perform and Protect Antibacterial Cleaner Spray, Sainsbury, UK.

### Control Variables

## Description of Actual Data Sample:

- **Initial N:** Four test surfaces and four antibacterial products
- **Attrition (final N):** As above
- **Age:** Not applicable
- **Ethnicity:** Not applicable
- **Other relevant demographics:** Not applicable
- **Anthropometrics:** Not applicable
- **Location:** School of Health and Social Sciences, Middlesex University, Queensway, Middlesex EN3 4SA, UK.

## Summary of Results:

### Key Findings

#### General:

- In this study, the effectiveness of the wipes was dependent upon the applier who controlled the amount of surface and degree of pressure applied
- Microbial survival was the indicator of antimicrobial effectiveness and the effectiveness of the products tested was dependent upon the type of surface (lower microbial reduction with plastic surfaces) and type of antimicrobial product (wipes were least effective compared to sprays).

#### Influence of Surface Type on survival of *E. coli* and *S. aureus* at various drying times:

- In the absence of any antibacterial products, wood and MIP surfaces affected significantly the survival of the bacteria, while glass and plastic surfaces had little effect
- The order of survival was glass to plastic to MIP to wood
- Nitroblue Tetrazolium was able to penetrate the pores of the wood surface, but in many cases did not result in any visualization of bacteria
- The glass surface allowed survival of both types of bacteria over all the drying times
- Both *S. aureus* and *E. coli* survived on plastic surfaces after 120 (100% and 56%, respectively)
- Survival of bacteria on MIP after 60 minutes was between 12-33% for *S. aureus* and 8-13% for *E. coli*.

#### Influence of surface type and bacteria on the effectiveness of the products tested:

##### Wood:

- *S. aureus* colonies were reduced to zero by all test products at 60 and 120 minutes
- Between one and five colonies remained on the wood surface inoculated with *E. coli* after 60 and 120 minutes.

##### Glass:

- The level of decontamination of every product on *S. aureus* decreased as the drying time increased ( $P < 0.05$ )
- Flash Wipes and Sainsbury's Antibacterial Wipes appeared to be the least effective in reducing bacterial number, between 22 and 42 *S. aureus* colonies survived after 120 minutes drying time
- In all cases, the overall reduction in cell number was greater than 88% as compared to the control
- Allowed efficient decontamination particularly by the antibacterial sprays (Dettol Antibacterial Surface Cleanser Spray and Sainsbury Perform and Protect Antibacterial Cleaner Spray) and in the case of *E. coli* by all the antibacterial products
- Two colonies were observed after 120 minutes drying time and the overall reduction of *E. coli* was  $>99\%$  in all cases.

##### Plastic:

- Significantly more difficult to decontaminate for both bacteria ( $P < 0.05$ ) with fewer products

able to reduce cells to zero

- Flash Wipes appeared to be the least effective on plastic
- As spray products applied directly at the plastic chopping board surface would have reached into the small indentations and made contact with the bacteria which may be missed by the antibacterial wipes, this may account for the apparent effectiveness of the former products; the results suggest there are significant risks of cross-contamination when using this type of chopping board and a proper cleaning regime should be followed to reduce the associated risks.

MIP:

- Flash Wipes were the least and Sainsbury Perform and Protect Antibacterial Cleaner Spray was the most effective in removing *S. aureus*
- Overall reduction of *S. aureus* using Flash Wipes was between 72% and 97%
- Sainsbury Perform and Protect Antibacterial Cleaner Spray removed all *S. aureus*
- The most effective products for removing *E. coli* from MIP were Sainsbury's Antibacterial All Purpose Wipes and Dettol Antibacterial Surface Cleanser Spray.

Comparison of the effectiveness of the antibacterial products:

- Flash Wipes were the least effective at disinfecting every surface. It is also the only product tested that advised the consumer to allow a specific contact time.
- At 30 and 60 minutes, Flash Wipes appeared to push the inoculum to the edge of the plastic surface; meaning these bacteria would remain at the edge of the cutting board potentially available to contaminate food either directly or via hands and utensils.
- Wipes were found to be less effective than sprays and this could be due to the amount of product received by the surface during the application of the two types of product, as surfaces always receive a greater amount of product from sprays
- This study showed that due to the nature of wipes they must come into direct contact with the bacteria to be effective.

### **Author Conclusion:**

- Bacterial survival on Wood and Microban® incorporated plastic surfaces were low after each drying time, whereas high levels of bacteria were detected on plastic and glass surfaces.
- Plastic showed the least effective decontamination using the test products and contrary to current thinking wood was not difficult to disinfect.
- The effectiveness of the products was not significantly affected by the type of bacteria used and only glass showed a decrease in effectiveness as drying time was increased.
- All of the products were effective at decontaminating the test surfaces with the exception of Flash Wipes, the only product to give a required contact time.
- While these products are effective at reducing bacteria on surfaces free of debris, their application without reference to instructions is unlikely to reduce the risk of cross-contamination.

### **Reviewer Comments:**

*Selection criteria for test surfaces and antibacterial products not described, small number of samples. Some limitations could be interpreted from what was stated within the results section:*

- *To truly test the effectiveness of these products in domestic kitchens, it would be necessary to carry out an in-use study; this would take into account food debris, consortium of bacteria and not monocultures of laboratory species of larger food contact surfaces*
- *The amount of product applied by a wipe was reliant on the applicator who controlled the area of the surface to which the product was applied and the level of pressure used.*

### Research Design and Implementation Criteria Checklist: Primary Research

#### Relevance Questions

- |    |   |                                    |
|----|---|------------------------------------|
| 1. | Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies) | <input type="button" value="Yes"/> |
| 2. | Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?   | <input type="button" value="Yes"/> |
| 3. | Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?  | <input type="button" value="Yes"/> |
| 4. | Is the intervention or procedure feasible? (NA for some epidemiological studies)  | <input type="button" value="Yes"/> |

#### Validity Questions

- |           |   |   |
|-----------|---|---|
| <b>1.</b> | <b>Was the research question clearly stated?</b>  | <input type="button" value="Yes"/>                                    |
| 1.1.      | Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?   | <input type="button" value="Yes"/>                                    |
| 1.2.      | Was (were) the outcome(s) [dependent variable(s)] clearly indicated?  | <input type="button" value="Yes"/>                                    |
| 1.3.      | Were the target population and setting specified?   | <input type="button" value="Yes"/>                                    |
| <b>2.</b> | <b>Was the selection of study subjects/patients free from bias?</b>   | <input style="background-color: #cccccc;" type="button" value="???"/> |
| 2.1.      | Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study? | <input style="background-color: #ff0000;" type="button" value="No"/>  |
| 2.2.      | Were criteria applied equally to all study groups?  | <input style="background-color: #cccccc;" type="button" value="???"/> |
| 2.3.      | Were health, demographics, and other characteristics of subjects described?   | <input style="background-color: #ff0000;" type="button" value="No"/>  |
| 2.4.      | Were the subjects/patients a representative sample of the relevant population?  | <input style="background-color: #cccccc;" type="button" value="???"/> |
| <b>3.</b> | <b>Were study groups comparable?</b>  | <input type="button" value="Yes"/>                                    |
| 3.1.      | Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)   | <input type="button" value="Yes"/>                                    |

3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	Yes
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
<b>4.</b>	<b>Was method of handling withdrawals described?</b>	<b>Yes</b>
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
<b>5.</b>	<b>Was blinding used to prevent introduction of bias?</b>	<b>Yes</b>
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
<b>6.</b>	<b>Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?</b>	<b>Yes</b>

6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
<b>7.</b>	<b>Were outcomes clearly defined and the measurements valid and reliable?</b>	???
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	???
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	???
7.7.	Were the measurements conducted consistently across groups?	???
<b>8.</b>	<b>Was the statistical analysis appropriate for the study design and type of outcome indicators?</b>	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A

8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	N/A
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
<b>9.</b>	<b>Are conclusions supported by results with biases and limitations taken into consideration?</b>	???
9.1.	Is there a discussion of findings?	No
9.2.	Are biases and study limitations identified and discussed?	???
<b>10.</b>	<b>Is bias due to study's funding or sponsorship unlikely?</b>	???
10.1.	Were sources of funding and investigators' affiliations described?	No
10.2.	Was the study free from apparent conflict of interest?	???

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