Effect of Scourers on Utensils and Bacterial Survival

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ABSTRACT

The objective of this study was to find the amount of bacteria that is trapped in scratches on tableware - plates/bowls/cups and other eating utensils, also to find the effect of different scouring pads on tableware. Six (6) types of kitchenware were washed with different types of scourers. The utensils were then closely examined for any damages or any scratches. Highly abrasive, light duty, moderate abrasive and spiral stainless steel ball most abrasive types of scourers were used. The most abrasive scourers, that is the stainless steel ball caused heavy scratches on most of the utensils used whereas the other scourers had very little or no effect on plates. To evaluate the bacterial load on scratched utensils, scratched plates were soiled with rice porridge mixed with Escherichia coli to mimic a contaminated plate and then the plates were washed. A batch of non scratched plates was used as control. A high bacterial load was seen on contaminated scratched plates washed with water and detergent without use of any scourers. It was observed that it is important to use appropriate type of scourers for the right type of plates to avoid any damages. Scratched or chipped plates can harbour bacteria and if not properly washed or sterilised can even cause disease.

Key words: Scourers, Utensils, Bacterial Load, Scratches.

1. INTRODUCTION

Often we look too far away for source of infection and factors leading to infection and disease. At a glance, our kitchen and the kitchen utensils might look clean and free from any kind of infectious agent (1). The main sources of potential harmful microorganisms in the home are contaminated food, contaminated water and contact with infected person (2). Contamination can also be passed from kitchen utensils or equipment when contacting food (3). This happens when utensils or equipment are not efficiently cleaned and sanitized between each use. Under favorable circumstances, some foods provide a safe haven for pathogenic microorganisms to survive when left to dry on the utensils (4). Microorganisms are trapped and easily missed by improper washing in scratched and broken part of dishware. Usually the plates and utensils are washed and scrubbed with dishwashing detergents and then rinsed with clean water (5). The survival of microorganisms on kitchen plates/utensils depends on several factors such as duration of leaving food on utensils until washed, frequency and method of washing, type of detergents and type of scourers used (6). In this study the different type of scourers on kitchen plates/utensils and the amount of bacteria that is trapped in scratches of the plates are assessed.

2. MATERIAL AND METHODS

2.1. Research methodology

2.1.1. Tableware and scourers

The different types of plates and utensils used in this study are; Non-stick pan, glass, porcelain, plastic, melamine and stainless steel plates. Types of scourers used; heavy Duty Scouring Sponge which is highly abrasive, delicate duty scrub sponge categorised as light duty, delicate Light duty, non scratch scrub sponge a moderate abrasive and metallic spiral ball a stainless steel ball the most abrasive of scourers.

2.2. Effect of different types of scourers on utensils

2.2.1. Study design

The kitchen utensils were washed with different types of scourers. Five (5) different types of scourers were used on every type of utensils. Six (6) utensils per type of scourers were used. The groups, type of utensils and type of scourers are summarized in Table 1. All The utensils were washed under the same conditions. They were all first rinsed with running tap water and then scrubbed by scourers using washing detergent cakes. The utensils were then allowed to dry and inspected for any form of scratch caused by the scourers using magnifying lens or dissecting microscopy.

Table 1. Different types of utensils and Scourers that were used

<table>
<thead>
<tr>
<th>Types of Scourers</th>
<th>Heavy Duty Scouring Sponge</th>
<th>Delicate Duty Scrub Sponge</th>
<th>Light Duty</th>
<th>Non Scratch Scrub Sponge</th>
<th>Metallic Spiral Ball</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-stick pan</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Glass plates</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Porcelain plates</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Plastic plates</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Melamine plates</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Stainless steel plates</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>
2.3. Laboratory evaluation of bacterial loads

Twenty milliliters of Brain heart infusion (BHI) Broth (Oxoid) was inoculated with ATCC strain of *E. coli* and incubated overnight at 37°C to produce a $10^9$ CFUs·mL$^{-1}$ concentration. Rice porridge was made to mimic the food used on daily bases in average Malaysian home. To simulate greasy expedition food, 10 ml of curry was mixed in to the porridge. To 20gm of porridge 2ml of the $10^9$ CFUs ml broth was added. This was mixed thoroughly to obtain a concentration of $10^8$ CFUs *E. coli* per 1 g of porridge. Two sets of plates were tested in this experiment. Set one plates were deliberately scratched to represent scratches caused during washing and handling. Set two plates were new unscratched plates. 20 g of porridge with *E. coli* were spread on the plates. After application of porridge the plates were left for about one (1) hour before they were washed with different types of scourers (Figure 1).

2.4. Sample collection

Sterile cotton swabs are moistened in sterile normal saline and then swabbed over the scratches on the tableware. The swabs were suspended in 10 ml of sterile saline. The suspension was then diluted by factors of 10, to give readable counts. One ml of this sample was then mixed with Columbia Blood Agar (Oxoid). The plates were then labelled, sealed and incubated over night at 37°C. The colony forming units (CFUs) were then counted.

2.5. Isolation and identification of bacteria

All cultures isolate after 24 hours will be observed for bacterial growth. Individual colonies will be subjected to gram staining and then sub-cultured for 24hrs at 37°C. The pure cultures are then examined macroscopically for size, texture, colour and other characteristics. A colony count was carried out. Microscopic study of the single isolated colonies was performed and all the isolates are then identified and subjected to sensitivity testing with the help of fully automated Vitek system.

2.6. Statistical analysis

The data will be expressed as mean ± standard error mean (SEM) and statistical analysis performed using analysis of variance followed by Student’s t-test with P<0.05 being considered as statistically significant.

3. RESULTS

The effect of different types of scourers on utensils shown in Table 2. From our observation after washing the utensils with different types of scourers, the most obvious damaging effect on utensils was caused by ‘Metallic Spiral Ball’ (stainless steel ball) (Figure 2). Almost all the utensils were heavily scratched using this particular scourers. The ‘Heavy Duty Scouring Sponge’ had scratched most of the plates to some degree, having the most effect on non-stick pans and glass plates (Figure 3). The rest of the scourers ‘Delicate Duty Scrub Sponge’, ‘Light duty’ and ‘Non Scratch Scrub Sponge’ showed no significant effects or scratches on any of the utensils (Figure 4).
A swab sample of the plates both scratched and non-scratched was processed for bacterial presence. Gram negative culture of E.coli was confirmed. The scratched plates showed significantly high load of bacteria irrespective of the type of scourers used (Figure 5). However the plates washed using ‘Metallic Spiral Ball’ and ‘Heavy Duty Scouring Sponge’ comparatively showed lower bacterial load to other scourers. The non-scratched plates showed a very low or no bacterial count after being washed with different scourers. There were no bacteria isolated from plates washed with ‘Heavy Duty Scouring Sponge’, ‘Light duty’ and ‘Non Scratch Scrub Sponge’. The bacterial loads of the other plates were not significant. To achieve total and completely bacterial free utensils some methods of sterilizations is required. Table 3 shows the mean bacterial load of scratched and non-scratched plates soiled with porridge containing E.coli.

### Table 2. The effect of different types of scourers on utensils

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of Scourers Plates</th>
<th>Heavy duty</th>
<th>Delicate care</th>
<th>Light duty</th>
<th>Non scratch</th>
<th>Metallic spiral ball</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-stick Pan</td>
<td>heavy scratches</td>
<td>Non</td>
<td>Non</td>
<td>Non</td>
<td>Heavy scratches</td>
</tr>
<tr>
<td>2</td>
<td>Glass Plate</td>
<td>heavy scratches</td>
<td>Non</td>
<td>Non</td>
<td>Non</td>
<td>mild</td>
</tr>
<tr>
<td>3</td>
<td>Porcelain plate</td>
<td>mild</td>
<td>Non</td>
<td>Non</td>
<td>Non</td>
<td>Heavy scratches</td>
</tr>
<tr>
<td>4</td>
<td>plastic plate</td>
<td>heavy scratches</td>
<td>Non</td>
<td>Non</td>
<td>Non</td>
<td>Heavy scratches</td>
</tr>
<tr>
<td>5</td>
<td>Melamine plate</td>
<td>heavy scratches</td>
<td>Non</td>
<td>Non</td>
<td>Non</td>
<td>Heavy scratches</td>
</tr>
<tr>
<td>6</td>
<td>stainless steel plate</td>
<td>mild</td>
<td>Non</td>
<td>Non</td>
<td>Non</td>
<td>Heavy scratches</td>
</tr>
</tbody>
</table>

**Figure 5**
The scourers ‘Delicate Duty Scrub Sponge’, ‘Light duty’ and ‘Non Scratch Scrub Sponge’ showed no significant effects or scratches on any of the utensils.

### Table 3 The mean bacterial load of scratched and non-scratched plates soiled with porridge containing E.coli

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of Scourers Plates</th>
<th>Heavy duty</th>
<th>Delicate care</th>
<th>Light duty</th>
<th>Non scratch</th>
<th>Metallic spiral ball</th>
<th>No scourers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scratched</td>
<td>2.3x10^7</td>
<td>2.1x10^7</td>
<td>1.3x10^7</td>
<td>3.8x10^7</td>
<td>1.6x10^7</td>
<td>9.5x10^7</td>
</tr>
<tr>
<td>2</td>
<td>Non-scratched</td>
<td>0</td>
<td>1.3x10^7</td>
<td>0</td>
<td>0</td>
<td>1.0x10^7</td>
<td>7.4x10^7</td>
</tr>
</tbody>
</table>

### 4. DISCUSSION

The limitation of this study was the use of different type of washing methods and conditions, type of food and duration of food on plates (7, 8). Some types of food and the duration can affect the outcome of washing even if the right type of scourers and washing method is used. In this study brand new scourers were used against new utensils (9, 10). However the scenario can be slightly different as the utensils and scourers are sometimes used way beyond their effective shelf life. It is worth to create awareness among people about the type of scourers for different type of utensils. In this study it was evident that damaged or scratched plates mainly caused by wrong type of scourers or by handling can significantly increase the bacterial load and possibly leading to infection (11). Leaving food on eating plates and cooking utensils for long will create favourable environment for microorganisms to survive and replicate, especially if the plates are scratched and not washed properly (12). It is highly recommended that dishes are washed immediately after food. Use of right type of scourers can definitely reduce the risk of infection and care for utensils.

### REFERENCES

RESEARCH

