



## **Executive Summary**

Studies have shown that more than 20 percent of foodborne illness outbreaks result from food that was consumed in the home<sup>1</sup>. NSF International food safety experts point to a number of contributing factors, including improper food storage, handling and preparation.

NSF International has a long history in working to help ensure safe design and cleaning of equipment or appliances used in food preparation. NSF's Commercial Foodservice Equipment Program began in the 1940s, focusing on equipment used in restaurants. NSF's Home Product Certification Program began in 2012, addressing kitchen appliances and tools used in the home. In addition to evaluating materials and design, the program evaluates manufacturers' cleaning instructions to help prevent equipment from harboring pathogens that can cause foodborne illness.

Because of NSF's role in evaluating the "cleanability" of common kitchen tools and appliances used in the home, the NSF microbiologists conducting the 2013 NSF International Germ Study analyzed 14 common kitchen items for the presence of four different types of microorganisms: *E. coli*, *Salmonella*, yeast and mold, and *Listeria*. The study found that many of these common kitchen appliances and tools used to prepare food do indeed harbor pathogens that cause foodborne illness. It's our hope that the information gained from this study will further underscore the importance of properly maintaining and cleaning these items.

### **The six "germiest" items contained the following microorganisms that can cause sickness:**

- 1.) **Refrigerator vegetable compartment:** *Salmonella*, *Listeria*, yeast and mold
- 2.) **Refrigerator meat compartment:** *Salmonella*, *E.coli*, yeast and mold
- 3.) **Blender gasket:** *Salmonella*, *E.coli*, yeast and mold
- 4.) **Can opener:** *Salmonella*, *E.coli*, yeast and mold
- 5.) **Rubber spatula:** *E. coli*, yeast and mold
- 6.) **Food storage container with rubber seal:** *Salmonella*, yeast and mold

### **Are We Unknowingly Making Ourselves and Others Sick?**

These germs were found on everyday kitchen appliances and tools that come in direct contact with food, especially raw produce, meat, poultry, seafood and ready-to-eat food. Importantly, volunteers correctly identified items that they thought would harbor the most germs, but they are not always cleaning them thoroughly to prevent illness.

As a result of these actions, people may be unknowingly making themselves, family and friends sick. The lesson we can all learn as consumers is to follow manufacturers' directions when it comes to cleaning and sanitizing kitchen tools and appliances. For instance, blenders need to be disassembled, and the gasket pulled apart from the base, to be cleaned. Refrigerator vegetable and meat compartments need to be cleaned and sanitized regularly. Like all kitchen tools, can openers need washing and sanitizing after each use and rubber spatulas that are detachable should be pulled off the handle to be cleaned. Lastly, rubber seals in food storage containers should be thoroughly cleaned. Detailed cleaning instructions for kitchen items included in the study are available on NSF International's [website](#).

### **At-Risk Populations:**

These germ study findings are most concerning for households with at-risk populations such as children, pregnant women, the elderly or those with a compromised immune system (from illness).

<sup>1</sup> Centers for Disease, Control and Prevention: Tracking and Reporting Food Disease Outbreaks, <http://www.cdc.gov/features/dsfoodborneoutbreaks/>



**Highlights from the analysis include:**

- ***E. coli* – 36 percent** of items contained *E. coli*. Items with *E. coli* included the refrigerator meat compartment, rubber spatula, blender gasket, can opener and pizza cutter.
- ***Salmonella* – 36 percent** of items had *Salmonella* including the refrigerator vegetable and meat compartments, can opener, blender gasket and the rubber seal on a food storage container.
- **Yeast and mold – All 14 items (100 percent)** tested positive for yeast and mold, and six items (43 percent) tested positive at concerning levels. The six items with concerning levels of yeast and mold were the refrigerator vegetable compartment, rubber spatula, blender gasket, refrigerator ice and water dispensers, and the rubber seal on a food storage container.
- ***Listeria* – 14 percent** of items tested positive for *Listeria*. The refrigerator vegetable compartment contained *Listeria*, as did the refrigerator door seal.

A recent U.S. Centers for Disease Control and Prevention (CDC) report sheds light on why it's so important to clean kitchen appliances and practice proper food safety to prevent the spread of germs. The CDC study found lettuce and leafy vegetables are the largest source of foodborne illness in the U.S., accounting for 2.2 million – or 23 percent – of the 9.6 million cases of foodborne illness reported each year from the CDC pathogens.<sup>2</sup> Produce foods, a category that includes vegetables, fruits and nuts, sicken 4.4 million people a year, according to the report. These foods – which are typically consumed raw – come in regular contact with the kitchen items that NSF tested for contamination.

**Other findings from NSF's 2013 Germ Study include:**

**Dark moist environments breed germs, even in the refrigerator:** The study found that kitchen items that were located in damp and dark areas consistently tested positive for harmful bugs such as *E. coli* and *Listeria*.

**Harmful bacteria are found on items that touch food:** NSF scientists observed that 36 percent of the items tested positive for *E. coli*, and these items come into direct contact with food.

**Germs build up in kitchen items that aren't often disassembled and cleaned:** Appliances and utensils that are not properly disassembled and cleaned according to the manufacturer's directions can harbor microorganisms. This highlights the need for consumer awareness of the importance of cleaning and food safety in homes.

**Cross-contamination and yeast and mold:** Storing food in contaminated storage containers or using water, ice or tools with high counts of yeast and mold may lead to food spoilage at a faster rate. For those with allergies to yeast and mold, these actions may lead to an allergenic response.

---

<sup>2</sup> Painter JA, Hoekstra RM, Ayers T, Tauxe RV, Braden CR, Angulo FJ, et al. Attribution of foodborne illnesses, hospitalizations, and deaths to food commodities by using outbreak data, United States, 1998–2008. *Emerg Infect Dis* [Internet]. 2013 Mar 7. <http://dx.doi.org/10.3201/eid1903.111866>



## An Examination of Perception vs. Reality

Before testing all these kitchen items, volunteers were asked to rate the items they thought would have the most germs. Below is a comparison of what were perceived to be the germiest items in the kitchen versus the actual germiest items (ranked from highest to lowest in germ count):

### **Volunteers thought:**

1. Microwave keypad
2. Can opener
3. Refrigerator meat compartment
4. Refrigerator vegetable compartment
5. Flatware storage tray
6. Knife block
7. Pizza cutter
8. Rubber spatula
9. Refrigerator insulating seal
10. Ice dispenser

### **Actual:**

1. Refrigerator water dispenser
2. Rubber spatula
3. Blender
4. Refrigerator vegetable compartment
5. Refrigerator ice dispenser
6. Refrigerator meat compartment
7. Knife block
8. Food storage container with rubber seal
9. Can opener
10. Refrigerator insulating seal

**What volunteers thought was dirty, but still didn't clean properly:** Volunteers thought that the vegetable and meat compartments would rank among the dirtiest items in the kitchen and they were right. What many volunteers may not have realized is that the types of germs found in these areas were harmful (such as *E. coli* and *Salmonella*) and come into direct contact with food, especially raw produce. What we learned is that 1) it isn't enough to wash your produce, you must also wash the areas where the produce is stored and 2) storing clean and unwashed produce together can be problematic.

**What volunteers thought was clean, but wasn't:** Many volunteers didn't consider their blender a germy item, but in reality, it was the third germiest item in the kitchen. The refrigerator water dispenser didn't make their list at all, but both the water and ice dispensers proved to be areas of concern for yeast and mold, which is a problem for those with allergies. The food storage container also never made the list, but later earned its place when the data revealed it was the eighth germiest item in the kitchen.